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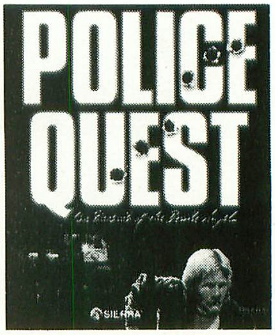
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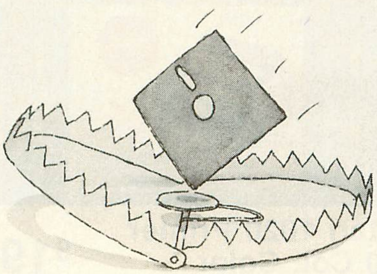
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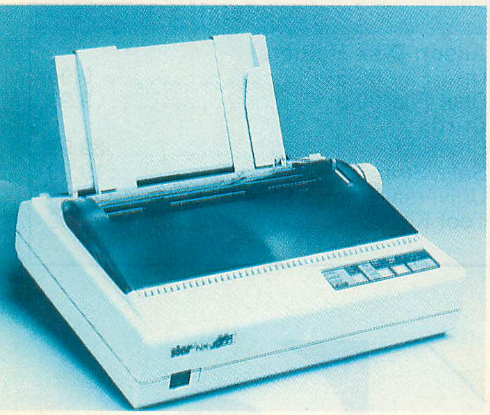




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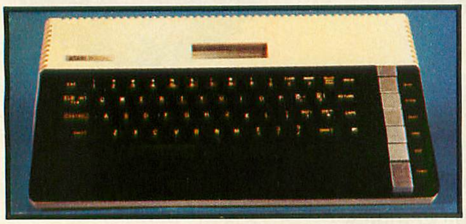
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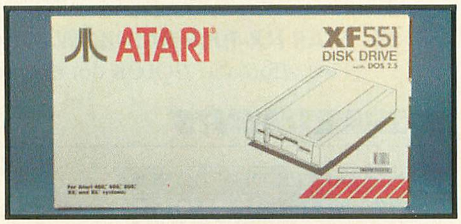
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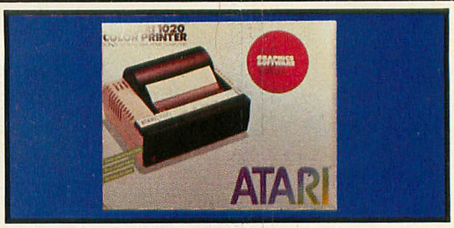
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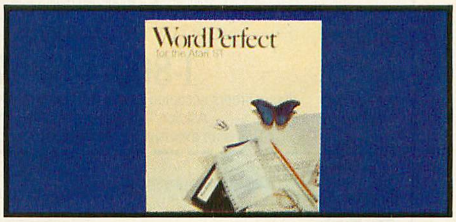
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YOUR 100% 8-BIT MAGAZINE



Antic isn't just talking about keeping the Atari 8-bit market alive, we're doing something new about it virtually every month.

Last month's **Antic** announced that our 8-bit Arcade Catalog was back, bigger than ever and even featuring reissues of top commercial software which had gone out of print. In this issue we proudly announce the arrival of the 8,500-page Antic Index on CompuServe's ANTIC ONLINE. The fast, friendly Antic Index database will enable you to find out which 1982-88 issue contained just about any **Antic** article, program, or review.

For years, **Antic** readers have been asking for a complete index to this magazine's back issues. Now that long-awaited reference tool is here. And it's even more than readers would have expected, because it draws on the full power of CompuServe's mainframe computers. The Antic Index is the result of months of work by Charles Jackson, our Technical and Online Editor, whose article this month explains how easily you can find exactly what you're looking for in the **Antic** back issues.

Not only does the Antic Index provide fast references to the correct back issue—many of the complete stories are available online for downloading.

Antic still believes in the future of the Atari 8-bit market and we're proving it by our actions—even at a time when so many others have fallen by the wayside. Starting with this issue, **Antic** has returned to being an **all Atari 8-bit magazine and disk** for the first time since May 1985.

In response to overwhelming reader demand, all ST coverage is being switched out of **Antic** into our ST-only sister publication START. (ST-owning **Antic** subscribers can transfer their subscriptions to START.) Undoubtedly you have noticed that the **Antic** Magazine you now hold is thinner than the previous four issues, and is staple-bound like the three issues from last summer. But this should cause only slight change for 8-bit owners, because the pages that were cut are the ST Resource section.

Why did we start reducing the number of pages in **Antic** this month? Antic Publishing is an independent business and this magazine must make a fair profit in order to keep going—we certainly don't get any subsidy money from Atari. **Antic** Magazine can still remain profitable at this smaller size, covering 8-bit Atari computers exclusively, with present amounts of readers and advertisers.

The catch is that the number of 8-bit advertisers has been dropping all along, so **Antic** must look for a higher level of reader support. In order for **Antic** to keep on finding new ways to do the job for your 8-bit Atari, *you* need to subscribe for 12 issues of **Antic** Magazine plus disk for only $59.95. (Or upgrade your magazine-only subscription to include the disk.)

Packed with 172K of high-quality Atari programs and graphics, each double-sided Antic Disk is an unequaled 8-bit software value. This month's disk features every type-in program from the issue—plus *Mandala Movies,* a hypnotically colorful kaleidoscope construction set, and a series of highly detailed pictures created with this issue's *Hard-Wired Ray Tracing* program.

Nat Friedland

Nat Friedland
Editor, **Antic**

ADDING SOME ZIP

I'd like to speed up my Atari 130XE. I notice that Apple II owners can upgrade their 6502 CPUs to 65C02, or a new product called the Zip Chip. I've heard that the 65802 is also pin-compatible. Can any of these microprocessors be used in my 130XE, and is it just a matter of swapping one chip? Will I see any performance improvement in such things as integer or floating-point calculations, memory read/writes or disk I/O? What kinds of problems might arise other than games running too fast?

James Johnson
Cambridge, MN

We asked Contributing Editor Matt Ratcliff about this and got the following reply: "GEnie has an extremely long thread on the subject of faster 6502s—even though it's been established that this is virtually impossible to do on an 8-bit Atari. And even if you got all the Atari's chips and operating system to handle a different microprocessor, what good is it? Only the software that you write yourself will work with it."—ANTIC ED

NX-1000

After reading the review of Star Micronics' NX-1000 printer (**Antic**, May 1988), I had reservations about such an inexpensive printer living up to its advertisements, but I bought one anyway.

I can only say that this printer has to be one of the best bargains around. I've teamed it up with a Supra 1150 interface and the combination works great. The graphics capabilities of this machine must be seen to be believed.

I've used it with Print Shop, Newsroom, AwardWare and PaperClip with no problem at all. It uses the same codes as the Epson LX80—and does just as well, if not better. For the price, this has to be one of the best printers around for 8-bit users.

Thorvald Ripley
Redondo Beach, CA

REAL REASON

I recently purchased an Atari 65XE with an XF551 disk drive and have noticed that not a lot of new third-party software is available for it. So I started phoning software companies to see if they would start making Atari 8-bit software as they do for the Commodore 64. They all told me basically the same thing—If they could get big orders, they would produce it. By "big orders" they meant national chains, such as Toys R Us and Child World/Children's Palace. Activision was the only company that said it was afraid of piracy.

So I went to the aforementioned stores in my area and spoke to the store managers, some of whom phoned their district managers, who said they'd order Atari 8-bit software if they got decent responses to the requests for it. So I urge all Atari 8-bitters to go to local stores as I did. Maybe we can all still benefit from new software for the 8-bit.

Robert Urbaniak
Williamsville, NY

Way to go! ***Antic*** *agrees that this kind of grass-roots effort is vital to the continued flow of third-party products for the 8-bit. That's what the successful* ***Antic*** *write-in campaigns have been all about.*—ANTIC ED

NX-CEPTION

I must take exception to your rather harsh review of the Star NX-1000 printer in the October 1988 **Antic**. I have used my NX-1000 Rainbow (the color version) for two months now and have nothing but praise for its quality and many special features.

I do agree that the rear cover can be difficult to remove, but I put a little silicon on the two tabs that hold it in place, and that has helped a lot. As for the front cover, how can you "expect" it to be one way or the other? Each of my previous three printers was unique in this respect.

I find the loading of fanfold paper to be no more difficult than on my previous printers, and I have yet to experience the paper popping out of the sprockets. (Did you raise the clamp levers to lock the sprocket units?) What's more, there is much less need to bother with loading and unloading fanfold paper. With the paper parking feature, you can automatically draw the fanfold paper out of the way, insert and type on single-sheet letterhead or envelopes and then reposition your fanfold paper, all without removing the rear cover or removing the paper from the sprockets.

I *never* waste a sheet of paper between printouts. If you start printing at the very top of the form, you do have to stand by to make sure that the first sheet gets tucked behind the paper bail, but this isn't difficult.

The quality of the NLQ printing is so good that I really don't mind waiting a few extra seconds. I especially appreciate that it's available with *any* print pitch. Had I read your review before purchasing my new Star, I probably would not have chosen it. So I'm glad my **Antic** arrived after the fact.

Carolyn Hoglin
Orlando, FL

Reviewer Gregg Pearlman replies: "I understand your point about the front cover, but I disagree. As it happens, the half-dozen or so printers I've reviewed for ***Antic*** *all had front covers that went on and off the same way—except the NX-1000. So I guess should have said that the cover 'goes on and off opposite from what I expected.' On the other hand, the* ***Antic*** *employee currently using the NX-1000 has removed the cover altogether—evidently he doesn't want to deal with the hassle either.*

'Antic's NX unit showed the problems described in my review while I was using the printer. As for wasting a sheet of paper, why should you have to make sure the next page is tucked behind the bail? On our previous Star printers (NL-10, NR-10, etc.) you don't have to. Essentially, what my review said was not that the NX-1000 was a bad printer, but that it wasn't the right printer for a user like me.—ANTIC ED

PAPERCLIP QUERY

Has anyone ever figured out a way to use PaperClip with a FingerPrint chip printer? I have an Epson RX-80 with a LetterWriter chip system in it and I have not been able to access the LetterWriter features from PaperClip. Electronic Arts was unable to help me, so I'm turning to you.

Glen Bergstedt
San Diego, CA

Sorry, we never tested that hardware, so we'll have to pass your question to the readers. Anybody got ideas?—ANTIC ED

Antic ***welcomes your feedback, but we regret that the large volume of mail makes it impossible for the Editors to reply to everyone. Although we do respond to as much reader correspondence as time permits, our highest priority must be to publish I/O answers to questions that are meaningful to a substantial number of readers.***
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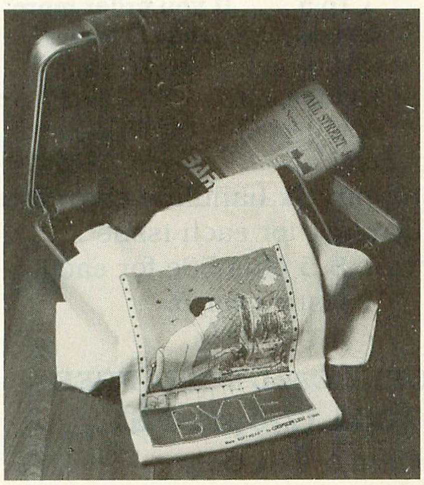
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(operating system)
USA Media
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Developed by Reeve Software and now brought out by USA Media, **Diamond OS** brings a complete windowing graphics operating environment to your Atari XL/XE/GS—just like the ST, says USA Media. Use the ST mouse, Atari joystick, touch tablet, trackball, or cursor keys to activate a pointer. Diamond lets you use icons, windows, drop-down menus, dialog boxes and desk accessories. Diamond can even access up to 16 megabytes of memory, for those who've been wondering what to do with their upgraded 8-bits. The disk version already available requires 64K memory. An enhanced cartridge version requiring only 48K is scheduled to be released in November 1988.

Diamond OS is the first release in the **ST, Jr.** line and will be required for using the other programs including **Diamond Paint**, a paint program complete with draw, block move, line, k-line, box, circle and airbrush features. Diamond Paint also accepts Degas pictures from the ST and MacPaint pictures. **Diamond Write** is a word processor that includes cut and paste, a complete spell checker, and an 80-column display. **Diamond Publish** is a desktop publishing system that creates text wrap-around graphics, text flow from column to column, and works with multiple-page documents. **Diamond Programmer's Kit** includes complete documentation for the Diamond environment and a resource editor that simplifies the creation of icons, drop-down menus, and dialog boxes. Programming samples in both BASIC and assembly language are also included in the kit.

SFP

(utility programs)
SFP
4 Forest Drive
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$21.95, 48K disk

SFP is a set of utility programs for use with Broderbund's SynFile+ file management system. Using the SFP utility programs you can create, save and produce reports in either list or label format; print or display the structure of a SynFile+ file; modify look-up tables; alter values associated with record number and counter fields; change justification of any data item and recover deleted records. SFP comes with DOS 2.5 and Turbo-BASIC (64K version) and supports the same densities as SynFile+ when used with appropriate DOS versions.

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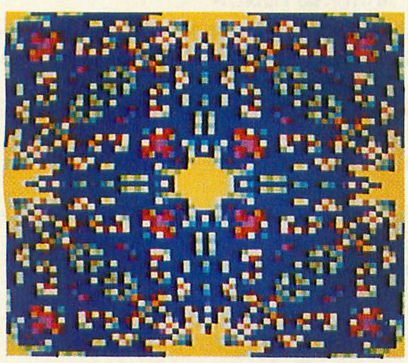
MANDALA MOVIES

Kaleidoscope Construction Set. By Mike McFarlane

Mandala Movies, this month's Super Disk Bonus, is an addictively creative kaleidoscope construction set. Using simple keyboard and joystick commands, you can effortlessly create an infinite number of fascinating designs that flow hypnotically in ever-varying patterns.

The fascinated **Antic** editorial staff had a great time testing the possibilities of Mandala Movies setting kaliedoscope patterns flowing across the monitors at unoccupied workstations for hours at a time. One **Antic** art department staffer was enthusiastic about using the vivid colors and striking patterns of Mandala Movies to design quilts or embroidery patterns. You can't save or print designs, but you can freeze the screen image and photograph it.

Mandala Movies is programmed entirely in speedy (but hard-to-type) machine language. Author Mike McFarlane did an excellent job with this highly artistic program. But, for reasons that would take too long to explain here, unfortunately **Antic** does not have McFarlane's current address. We believe he lives in the Eugene, Oregon area and we'd love to hear from him, or from anyone who knows where to find him, so we can send Mike's author fee.

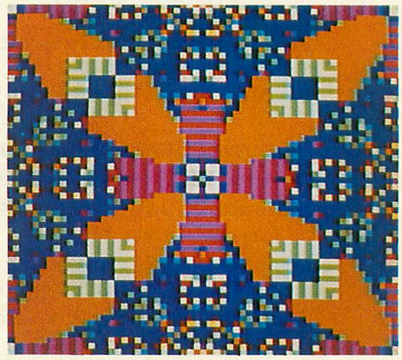


USING THE PROGRAM

Use DOS command O to copy the MANDALA.EXE file to another disk that includes the DOS.SYS file. *Don't* attempt to run Mandala Movies directly from the monthly Antic Disk. Use DOS command E to rename MANDALA.EXE to AUTORUN.SYS. Turn off your computer and remove all cartridges. Place the disk in drive 1. If you're using an XL or XE, hold down the [OPTION] key while you turn on your computer. Mandala Movies will load and run automatically.

After a short demonstration run, you can start experimenting with Mandala Movies. Follow the on-screen prompts for instructions. With just a few keystrokes and a nudge of the joystick you can produce striking kaleidoscope patterns that will amaze your friends.

Mandala Movies operates in GTIA mode 10, letting you work with eight colors in your design, plus one color for the background. In Color Selection mode you can adjust the colors to your liking, and even watch



your current pattern change while you experiment with new colors. After you have an image you like, you can start it scrolling across the screen in several patterns for an entertaining visual display.

Your February 1989 Antic Disk—featuring Mandala Movies as well as every type-in program from this issue—will be shipped to you within 24 hours after receiving your order. Just phone Toll-Free to the Antic Disk Desk at **(800) 234-7001**. The monthly disk is only $5.95 (plus $2 for shipping and handling) on your Visa or MasterCard. Or mail a $5.95 check (plus $2 shipping and handling) to Antic Disk Desk, 544 Second Street, San Francisco, CA 94107.

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Ultimate Atari reference tool goes online.

Antic Index

By Charles Jackson, **Antic** Technical and Online Editor



Introducing the Antic Index, newest addition to ANTIC ONLINE and CompuServe. The Antic Index is the most comprehensive guide to back issues of **Antic** and START. If the Antic Index was published as a book, it would contain more than 8,500 pages of product reviews, new product announcements, I/O letters, programming tutorials, feature articles and news bulletins.

Need Atari information *fast*? It's all just seconds away. Find it in the Antic Index, the largest, fastest electronic guide to information about your Atari. And best of all, there's *no extra fee*. You pay only standard CompuServe connect charges. There's never any extra fees or surcharges for using the Antic Index. Just type GO ANTIC and select menu choice 10, The Antic Index.

The Antic Index is primarily an electronically searchable database covering every article ever published in **Antic**, from the 1982 first issue till the beginning of 1989—plus most articles from START. But the Index is also a *library* as well as a database. So far, you can actually download some 20% of the complete **Antic** articles, perhaps half of the complete START text, and many original major features from ANTIC ONLINE such as Tim Oren's Professional GEM columns and Chris Crawford's Assembly Language tutorials.

The Antic Index, currently at the seven megabyte mark, is an ongoing project of ANTIC ONLINE. Every week we'll be adding more and more information from old and new issues of START and Antic. The Antic Index is an all-text reference service, so it cannot contain any photographs, diagrams, advertisements or program listings. If you need to see a diagram or use a program, you can order $3 back magazines or $5 back disks from the Antic Disk Desk. Just phone (800) 234-7001 with your Visa or Mastercard order, or see the ad in this magazine for details on a magazine/disk back issue special offer.

If you ever needed a clear programming tutorial, a helpful product review, or just a fun game from **Antic** or START back issues, there used to be only one way to find it. Slide out your box of old magazines, start with the most likely-looking issue, search through each page. If you never missed or lost an issue and if you know exactly what you're looking for, you'll probably find the information you need. You'll also be quite a bit older than when you started.

Now there's an easier way. In a few seconds, the Antic Index can find your article, right down to the page number. In many cases, the index also contains the complete text of the article. Just "capture" the information you need. There's nothing simpler or faster. Let the Antic Index be your first stop when you need Atari information

fast. It'll probably be the only stop you need.

ELEVEN WAYS TO SEARCH

If you ever used a card catalog to find a library book, you'll have very little trouble using the Antic Index. A typical card catalog offers two ways to find a book—by author and by subject. The Antic Index gives you *eleven* ways to find an article. You can search by:

1 **Author's Name**
2 **Month of Publication**
3 **Year of Publication**
4 **Subject**
5 ***See a List of Subjects/Search***
6 **Department**
7 ***See a List of Departments/Search***
8 **Programming Language**
9 **Program Name**
10 **Article Title**
11 **Magazine Title**

Use the **Author's Name** option to find all articles written by a particular author. For example, if you wanted to know when Russ Wetmore wrote those articles about the 1030 modem, you would search by **Author's Name** for WETMORE. The index software searches through its database and compiles a list of every article written by WETMORE. This list is called a *selection set*. Once a selection set is created, it's put into a menu and displayed onscreen. Now, just type in the number of the article you want to see.

The **Month** and **Year of Publication** options let you restrict your searches to a specified date.

Use the **Subject** option to find all articles written by about a particular subject, such as Printers, Desktop Publishing and Business. If you need more help, use the ***See a List of Subjects/Search*** option to display a list of more than three dozen commonly used subject headings.

Use the **Department** option to find all articles written for a particular subject, such as New Products, ST Section, and Features. Again, if you need more help, use the ***See a List of Departments/Search*** option to display a list of commonly used department headings.

The **Program Name** and **Programming Language** options only search through articles which contain program listings. For example, you could search by **Program Name** to learn when **Antic** ran the STRETCH.ACT program. Use the **Programming Language** option when you know what language the program was written in. This option, for example, could find every ACTION! program **Antic** has printed. Just remember that the Antic Index is an all-text service and cannot contain program listings, only the accompanying articles.

The **Article Title** option finds an article by its title. If you entered "online," the Index would find every article which has the word "online" anywhere in its title.

SEARCH STRATEGIES

The **Magazine Title** option lets you restrict your searches to **Antic** Magazine, START Magazine, or ANTIC ONLINE.

Even if you don't remember the *exact* title of the article, or even how to spell the author's name, the Antic Index can still help. For example, if you needed Lawrence Dziegielewski's "Disk Drive Survey," but couldn't remember how to spell Dziegielewski, you could search by **Author's Name** for any part of the name you *could* spell. Searches for "Dz" or "ski" would find the article almost as quickly as a search for Dziegielewski.

Of course, you could have found the same article by searching by **Subject** for "Review" or searching by **Article Title** for "Disk."

In most cases you don't need to type-in the entire search term. A few well-chosen keywords will do. Imagine you're looking for an article titled: "3-D Fractals: Three-dimensional ST landscapes."

But you could only remember that the article had the word "fractal" in it. No problem. Select choice 10, **Article Title** from the SEARCH BY menu, and type the word "fractal" at the "Enter Article Title:" prompt. Here's what you'll see:

```
Enter Article Title: fractal
6 articles selected
ANTIC ONLINE ABSTRACTS
1 Faster Fractals
2 Fractals For Your Atari
3 Fractal Zoom
4 3-D Fractals: Three dimension
5 Fractal Congratulations
6 Ballblazer & Rescue On Fractal
Enter choice !
```

The index creates a menu listing every article which has the word "fractal" in its title. The "3-D Fractals: Three Dimensional ST Landscapes" article is choice #4.

Type a 4 at the "Enter choice !" prompt, for complete bibliographic information about the article—including author, which issue it appeared in, the page number, and whether there are any type-in listings. If the complete text of the article has already been uploaded, it will appear

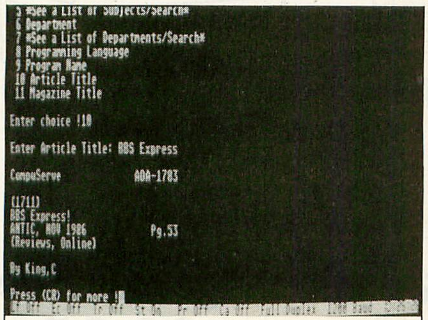
If the Antic Index was published as a book, it would contain more than 8,500 pages.

when you press [RETURN]. Otherwise, that [RETURN] will take you back to the SEARCH BY menu.

COMBINING TERMS

Sometimes the categories you select will be too broad. For example, searching for New Products would produce a selection set with more than 450 articles!

Whenever your selection set has more than 50 articles, you can add another search method. This is called "narrowing" your search. Here's what the screen would look like at this point in your New Products choice:



The Index is a library and a database.

Enter Department: New Products
455 articles selected

The Index has found 455 articles containing new product announcements. If you can remember anything else about the article, such as the year it was published, you can eliminate the articles published in other years.

For example, if you know that the new product announcement was published in 1985, you'd narrow your search by eliminating all other years. This time, the Index will only search through the 455 "New Products" articles it found during its last search. It will *not* search through every article in the database. Here's what you'd see:

SELECT YEAR PUBLISHED:
1 1982
2 1983
3 1984
4 1985
5 1986
6 1987
7 1988
8 1989
Enter choice !4
77 articles selected

From the 455 New Product articles, the index has selected the 77 which were published in 1985. From here, you can continue to narrow your search, start a new search, or display a menu of the selected articles.

SEARCH TIPS

When combining several search methods, it's usually easiest to start with the method that will produce the largest selection set, and narrow from there.

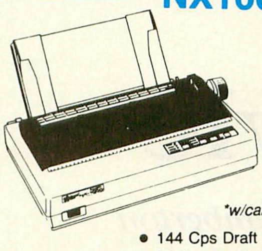
Since you may only "narrow" a selection set having more than 50 members, try to start your search with the method most likely to find at least 50 articles. The following examples illustrate this strategy.

SAMPLE TASK: Find all the articles written by Tim Oren in 1985.

Strategy #1: If we begin by searching **Author's Name** for Oren, the index finds only 26 articles. Since we need more than 50 articles to use the "narrow" function, we must examine the publication date of each article, until we've found those published in 1985. Strategy #2: If we begin by searching **Year of Publication** for 1985, the index finds more than 250 articles. From here, we narrow the selection set by searching **Author's Name** for "Oren." Almost immediately, the six Tim Oren articles from 1985 appear. ▲

Antic Technical and Online Editor Charles Jackson designed and put together the Antic Index and ANTIC ONLINE.

star micronics NX1000



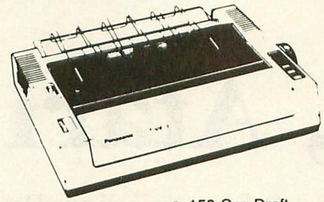
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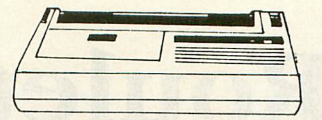
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Roulette, Atari Style

You won't lose your shirt to the 8-bit croupier. *By Michael Pemberton*



Why buy a roulette table when your Atari can be a championship casino croupier? This BASIC program works on 8-bit Atari computers with at least 48K memory, disk or cassette.

My luck in casinos has been consistently poor. I figured that the best way to survive an upcoming trip to Vegas would be to practice the games I was most interested in—craps, blackjack and roulette.

Now, I own some dice and some cards, but I don't know anyone with a roulette table stashed away in the garage. Undaunted, I rolled up my sleeves, put on my shaded visor and wrote a program to play Roulette on my Atari 800.

GETTING STARTED

Type in Listing 1, ROULETTE.BAS, check it with TYPO II and SAVE a copy before you RUN it.

If you have trouble typing the special characters in lines 140-144, don't type them in. Instead, type Listing 2, check it with TYPO II and SAVE a copy. When you RUN Listing 2, it creates these hard-to-type lines and stores them in a file called LINES.LST. To merge the two programs, disk users LOAD "D:ROULETTE.BAS" and then ENTER "D:LINES.LST." Cassette users: CLOAD Listing 1, then insert the separate cassette used for Listing 2 and ENTER "C:". Remember to SAVE the completed program before you RUN it.

When you RUN Roulette, the titles will appear and the screen will go blank for about 10 seconds while the program draws the gameboard, coloring the "red" numbers with Player/Missile graphics. When the screen turns on again, the Roulette board will appear with the cursor in the upper left-hand corner.

With a joystick in Port 1, you can move the cursor to any position on the board and place bets. Pressing the joystick button puts a chip at the cursor position. A buzzer will sound if you try to place a bet on an illegal spot.

You'll be asked to verify the bet and say how much money you want to wager. You can risk any amount on a single bet, as long as you don't exceed the amount of cash you have on hand. Betting $0 counts as no bet, and your chip will be removed from the board. To increase the amount of a bet, just put a second bet in the same area of the board and the software will add it in.

Once you place all your bets, press [START] to spin the wheel. The spin-

ning numbers will appear below the betting board and will go through the whole sequence *at least twice* before settling on a winning number.

When that winning number comes up, the computer will determine your winnings, if any, listing each successful bet with the amount of money it's won for you. If you go broke, the computer will let you start over. To bet again, just press [RETURN]. That's all there is to it.

BETTING ON ROULETTE

Now all you have to do is learn the authorized roulette bets.

There are 11 different kinds of bets in Roulette. This may sound complex, but the system is actually very easy to learn.

There are 11 different kinds of bets in Roulette. This may sound complex, but the system is actually very easy to learn, and you place bets with this program *exactly* as you would if you were in a real casino. Here is how the bets work:

1. Straight bets: you bet on any single number. Put your chip right inside that number's square. Pays **35 to 1**.

2. Split bets: you bet on any two adjoining numbers (0 and 00 adjoin only each other). Put your chip on the line between the two numbers. Pays **17 to 1**.

3. Street bets: you bet on any three numbers in a vertical line. Put your chip on the outside edge of the board (top or bottom) where the "street" ends. Pays **11 to 1**.

4. Square bets: you bet any four numbers grouped together in a square (for example, 7, 8, 10, 11). Put your chip at the point where they all meet. Pays **8 to 1**.

5. Line bets (5): you bet on the five numbers 0, 00, 1, 2, 3. Put your chip at the top or bottom of the line that connects these five numbers. Pays **6 to 1**.

6. Line bets (6): you bet on the six numbers that border one of the 11 vertical lines on the board (for example, 13 through 18). Put your chip at the top or bottom of the line you're betting on. Pays **5 to 1**.

7. Column bets: you bet on the 12 numbers in one of the three horizontal ranks across the board. Put your chip on the right-hand edge of the column you're betting on. Pays **2 to 1**.

8. Dozen bets: you bet on either the first, second or third dozen numbers on the wheel. All dozens lose on 0 or 00. Put your chip inside the 1ST DOZEN, 2ND DOZEN or 3RD DOZEN box. Pays **2 to 1**.

9. High/Low bets: you bet on either 1 to 18, or 19 to 36. All high/low bets lose on 0 or 00. Place your chip in either the 1-18 box or the 19-36 box respectively. Pays **even money**.

10. Odd/Even bets: you bet on whether the winning number will be odd or even. All odd/even bets lose on 0 or 00. Put your chip in the ODD or EVEN box. Pays **even money**.

11. Black/Red bets: same as Odd/Even, except you put your chip in the BLACK or RED box. Pays **even money**.

I have yet to find any betting strategy that wins consistently (no surprise there!), but I'll keep trying. Maybe you'll do better.

PROGRAM TAKE-APART

The key to this Roulette program lies in the configuration of BET$, which identifies the kind of bet being made. The ATASCII value of each character in BET$ specifies a certain type of bet—1-38 are the straight bets, 39 is a line bet (5), 40-97 are the split bets, etc. The program notes the cursor's horizontal and vertical position when a bet is made, uses them to identify a corresponding character in BET$, translates this character into a numerical value with the ASC function and then decodes and records the bet in the appropriate variable.

The wheel is spun via the RND function, and it will go through two to five complete rotations before stopping on a number. The starting position for successive spins is the number which has just won. (This happens in Las Vegas roulette too.)

Finding out which bets (if any) have won is simple. The possible winning numbers are determined for each bet, and if one matches the actual winning number, the original amount bet is automatically returned to your stake and the winnings are calculated.

10-510	Game Setup
900-1070	Cursor Movement
1075-1160	Interpret Bet Type
1190-1630	Record Bets and Amounts
2000-2040	Spin the Wheel
3000-3530	Display Winnings
4100-4520	Bet and Gameboard Subroutines
5000-5060	Gameboard Configuration
6000-6120	BET$ Character Codes
6130-6140	Roulette Wheel Numbers

Michael Pemberton is working on a Ph.D. in English at the University of California, San Diego.

Listing on page 26

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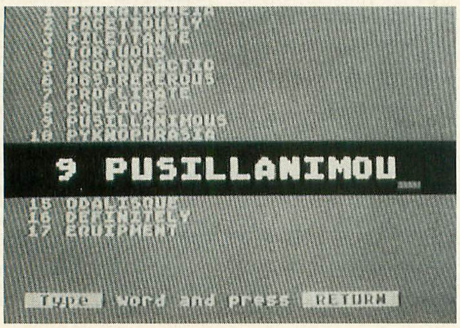
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Spelling Flashcards

Friendly quiz that kids like using. *By Andy Barton*



Spelling Flashcards is a simple, versatile spelling quizzer for all ages. It's enjoyable for kids, without intimidating them by excessive flash. This BASIC Program works on all Atari 8-bit computers with at least 48K memory and a disk drive.

Spelling Flashcards is a simple, versatile spelling drill for all ages. Like *Math Flashcards,* the predecessor program I wrote (**Antic**, October 1987), this spelling quizzer program is friendly and interesting with a little color and music. But it doesn't distract or intimidate kids with unduly flashy displays.

You easily create your own lists of hard-to-spell words. Then Spelling Flashcards will randomly pick a word and flash it on the screen.

If you spell the word correctly, you're rewarded with an ever-changing little tune. Otherwise, the screen turns red, the word flashes again, incorrect letters are blanked out and you get to try again. After you type the word correctly, that word will be repeated three more times during the quiz to help you get it down perfectly.

Speed is important, too. If you take too long to spell a word, the program considers it incorrect. At the end of the quiz, Spelling Flashcards shows you the number of correctly spelled words and the total number of words tried.

GETTING STARTED

If you put Spelling Flashcards on a separate disk, its menu will be easier to read. Format a fresh disk with DOS 2.0 or DOS 2.5 and write the DOS files to it. Type in Listing 1, SPELLING.BAS, check it with TYPO II and SAVE a copy before you RUN it.

If you have trouble typing the special characters in lines 5860-5870, don't type them in. Instead, type Listing 2, check it with TYPO II and SAVE a copy. When you RUN Listing 2, it creates these hard-to-type lines and stores them in a file called LINES.LST. To merge the two programs, LOAD "D:SPELLING.BAS" and then ENTER "D:LINES.LST." Remember to SAVE the completed program before you RUN it.

When RUN, the program displays a file menu of all the Spelling Flashcard lists on your disk. The menu at the bottom of the screen lets you load one or more Spelling Flashcards lists, edit a list, or create a new list.

Type a list's number to load it into

Spelling Flashcards. You can choose a single number, several numbers separated by commas or two numbers separated by a hypen, indicating a block of files. For example, type a 3 to load list number 3. Type 3,5,9 to load lists 3, 5 and 9. Type 5-8 to load lists 5, 6, 7 and 8.

Edit a list by typing E followed by the number of the list you wish to edit. For example, typing E7 will let you edit list number 7. Finally, type N to create a new list of spelling words.

CREATING A LIST

If you're typing-in SPELLING.BAS, you'll need to create a few lists before you continue. Antic Disk owners will find several spelling lists on this month's disk. These lists have a .DAT file extender.

To begin your list, type N. The program will ask you for a title of your list. The title can be up to 8 characters long, and will be used to store your list to a disk file. While you may type most anything you wish, the program will adjust it to conform to a standard Atari disk filename, and add a .DAT extender.

Spelling Flashcards will display the adjusted filename and ask you if it is correct. Press N to change the filename, or press any other key to accept it. Pressing [RETURN] without typing a title sends you back to the main menu without creating any new lists.

Next you're asked to select the number of seconds you wish the word to be flashed on the screen. The default is 0.75, but younger children might find one or two seconds more reasonable and less threatening. You can also change this value later in the Edit mode, if you wish.

Now type in your list. Each word can be as many as 15 characters long, including hyphens, apostrophes, and spaces. Numbers and lowercase letters are not allowed. You may have up to 40 words per list. When you're done, press [RETURN] to save your list to disk.

PLAYING THE GAME

After the program loads the list(s) you selected, you'll see the words displayed onscreen for you to review. Press any key to start the drill.

Spelling Flashcards randomly selects a listed word and briefly flashes it onscreen. Your task is to type it in. The [DELETE] and arrow keys will fix any typing mistakes you make. After you spell the word, the program will check it. There is no need to press [RETURN].

Correctly spelled words are rewarded with a brief ever-changing tune. Misspelled words turn the screen red and must be corrected. They are repeated three times on orange screens, mixed in with new words.

Correctly spelled words are rewarded with a brief ever-changing tune.

If you are totally stuck, press [RETURN] to flash the word onscreen again. This counts as a misspelling. If you do not type the word quickly enough, you'll also be penalized for a misspelling.

Errors are not monitored directly, but the number of tries and the number of correct answers are counted. The purpose of the drill is to teach, not penalize.

When you're done, Spelling Flashcards plays a longer random tune. Press any key to go on to your next list or return to the main menu.

EDIT A LIST

The New List and Edit options share a section of programming. Adding, correcting and deleting words is done the same way. When a key is pressed, a Graphics 2 window opens in the middle of the screen. You'll enter and edit words within this window.

To add a word simply type it. To edit a word, type the number of the word in the list displayed onscreen, then edit the word. You don't need to press [RETURN], but the second digit of a two-digit number must be pressed within 0.5 seconds.

The [DELETE] and [CONTROL]-[DELETE] keys work in the normal Atari fashion. Move the cursor (a blue bar below the letters) with the left and right arrow keys. You do not need to press [CONTROL] to use these keys.

Press [RETURN] to accept the word and display the updated list. To delete a word, simply bring it into the window by typing its number, [DELETE] or [SPACEBAR] over each letter and press [RETURN]. When you are finished with a list, press [RETURN] to save it to disk and return to the main menu.

PROGRAM TAKE-APART

Spelling Flashcards is written upside down, with the initialization routines and lesser-used portions at the end of the program. The frequently used subroutines are at the top, where BASIC can find them quickly.

Lines 5500-5570. The initialization section starts with a table of parameters which you can customize. DVIEW in line 5550 is the default value for the length of time a word is flashed on the screen. You can experiment with different values when you enter or edit a list. If you want the timer to use a different default

value, put it in line 5550. If you change line 5550, remember to SAVE the program to make the change permanent.

Lines 5860-5870 contain a speedy machine language "memory move" routine, a modified version of a USR routine from **Antic** Tech Tips (January 1985, page 64). Here, I use it to copy the character set from ROM to RAM, where it is redefined at line 5900.

Lines 4500-5020: This routine reads and displays the disk menu. See **Antic** Tech Tips, July 1986, page 87.

The main menu, as well as word lists, are displayed in the largest graphics mode possible. The program uses Graphics 2 if the list is 10 words or less and Graphics 1 if it is 20 or less. Larger lists use Graphics 0. Lines 4600 and 3130 do this with a little Boolean math. In one line, this routine does the same work as three or four lines of IF-THEN statements. (See **Antic**, August 1984, pages 48-52.)

Line 3230-3360. The main loop of the program is short, but uses subroutines extensively. And many of these subroutines call *other* subroutines. The result is a compact, easy-to-type program.

Within this loop, the matrix TRACK(X,X) keeps track of the status of the words in your list. It has two rows. Row (0,X) contains a random series of numbers. Each number corresponds to a word in the spelling list. The program uses this information to build its random list of words.

Row (1,X) records how many more times a misspelled word must be repeated. TRACK(1,0) is a flag which directs the main loop to the proper combination of subroutines for either the basic drill or the misspelled drill.

Lines 110-140. The first subroutine is a timer. It is short, clean and accurate. Probably most every other programmer knows about it. But I just recently stumbled upon it in a article I read but forgot years ago (**Antic**, March 1984, pages 19-21). If you're not familiar with Atari's built-in countdown timers, take a second to check them out.

A countdown timer is a system timer that counts backwards and uses jiffies (60 jiffies = one second) instead of seconds. This program uses CDTMV3, system timer 3. Here's how to use countdown timers:

1. Determine the length of time you need to monitor, and convert this value into jiffies. Five seconds, for example, is equal to 300 jiffies.

2. Separate this value into low-bytes and high-bytes. The low and high-byte values of 300, for example, are 44 and 1.

3. Temporarily turn off the clock by placing a 1 (or any non-zero value) into CRITIC, the critical I/O region flag (memory location 66, $42).

4. Set the timer by placing your low and high-byte values into the countdown timer register. In this example, we're using countdown timer 3, CDTMV3, which is accessed through memory locations 540 and 541 ($021C and $021D).

5. POKE a zero into CRITIC to turn the clock back on and start counting.

6. Monitor countdown timer flag 3, CDTMF3, memory location 554 ($022A). When PEEK(554)=1, time is up! See line 3880 where the program is waiting for either a key to be pressed or the timer to run out before it moves on.

You easily create your own lists of hard-to-spell words.

Here's one last item you may wish to customize. I hate pressing [RETURN] if it is not absolutely necessary. This program was designed with that bias in mind. However this poses a problem when you could choose to enter a 1 or 2 digit number. This happens in the Edit section of the program when you could choose to edit word 1 or word 15.

Problem: How is the program going to know when you are through if you don't press [RETURN]? Solution: set a brief time limit for entering the second digit. Line 3870 does this: SEC=0.5:GOSUB 110 sets the timer for half a second. If this is too short, you can increase the 0.5 to a larger number. Again, remember to SAVE the program if you want to make the changes permanent. ▲

Andy Barton has been a frequent ***Antic*** *contributor since 1984. To his credit are such programs as* Son Of InfoBits *and* TYPO II, ***Antic's*** *type-in listing proofreader. TYPO II has appeared in every issue since January 1985.*

Listing on page 34

SOFTWARE LIBRARY

TYPING SPECIAL ATARI CHARACTERS

The Atari Special Characters and the keys you must type in order to get them are shown below:

For [CONTROL] key combination, *hold down* [CONTROL] while pressing the next key. For inverse [CONTROL] [A] through [CONTROL] [Z], press the [◪] key—or [⅄] on the 400/800—then *release* it before pressing the next key. (Press [◪] or [⅄] again to turn off inverse.) For [ESC] key combinations, press [ESC] and then *release* it before pressing the next key.

Carefully study the chart above and pay close attention to differences between lookalike characters such as the slash key's [/] and the [CONTROL] [F] symbol [◪].

NORMAL VIDEO

FOR THIS	TYPE THIS	FOR THIS	TYPE THIS
	CTRL ,		CTRL S
	CTRL A		CTRL T
	CTRL B		CTRL U
	CTRL C		CTRL V
	CTRL D		CTRL W
	CTRL E		CTRL X
	CTRL F		CTRL Y
	CTRL G		CTRL Z
	CTRL H		ESC ESC
	CTRL I		ESC CTRL −
	CTRL J		ESC CTRL =
	CTRL K		ESC CTRL +
	CTRL L		ESC CTRL *
	CTRL M		CTRL .
	CTRL N		CTRL ;
	CTRL O		SHIFT =
	CTRL P		ESC SHIFT CLEAR
	CTRL Q		ESC DELETE
	CTRL R		ESC TAB

INVERSE VIDEO

FOR THIS	TYPE THIS
	ESC SHIFT DELETE
	ESC SHIFT INSERT
	ESC CTRL TAB
	ESC SHIFT TAB
	⅄ CTRL .
	⅄ CTRL ;
	⅄ SHIFT =
	ESC CTRL 2
	ESC CTRL DELETE
	ESC CTRL INSERT

TYPO II AUTOMATIC PROOFREADER

TYPO II automatically proofreads **Antic**'s type-in BASIC listings. Type in the listing below and SAVE a copy to disk or cassette. Now type GOTO 32000. At the prompt, type in a single program line **without the two-letter TYPO II code at the beginning**. Then press [RETURN].

Your line will reappear at the bottom of the screen. If the TYPO II code does not match the code in the magazine, then you've mistyped your line.

To call back a previously typed line, type [*], then the line number, then [RETURN]. When the completed line appears, press [RETURN] again. This is how TYPO II proofreads itself.

To LIST your program, press [BREAK] and type LIST. To return to TYPO II, type GOTO 32000. To remove TYPO II from your program, type LIST "D:FILENAME",0,31999, then [RETURN], then NEW, then ENTER "D:FILENAME", then [RETURN]. Now you can SAVE or LIST your program to disk or cassette.

Don't type the TYPO II Codes!

```
WB 32000 REM TYPO II BY ANDY BARTON
VM 32010 REM VER. 1.0 FOR ANTIC MAGAZINE
HS 32020 CLR :DIM LINE$(120):CLOSE #2:CLO
   SE #3
BN 32030 OPEN #2,4,0,"E":OPEN #3,5,0,"E"
YC 32040 ? "K":POSITION 11,1:? "TYPO II"

EM 32050 TRAP 32040:POSITION 2,3:? "Type
   in a program line"
HS 32060 POSITION 1,4:? " ":INPUT #2;LINE
   $:IF LINE$="" THEN POSITION 2,4:LIST B
   :GOTO 32060
XH 32070 IF LINE$(1,1)="*" THEN B=VAL(LIN
   E$(2,LEN(LINE$))):POSITION 2,4:LIST B:
   GOTO 32060
TH 32080 POSITION 2,10:? "CONT"
MF 32090 B=VAL(LINE$):POSITION 1,3:? " ";
NY 32100 POKE 842,13:STOP
CN 32110 POKE 842,12
ET 32120 ? "K":POSITION 11,1:? " TYPO II 
   ":POSITION 2,15:LIST B
CE 32130 C=0:ANS=C
QR 32140 POSITION 2,16:INPUT #3;LINE$:IF
   LINE$="" THEN ? "LINE ";B;" DELETED":G
   OTO 32050
VV 32150 FOR D=1 TO LEN(LINE$):C=C+1:ANS=
   ANS+(C*ASC(LINE$(D,D))):NEXT D
WJ 32160 CODE=INT(ANS/676)
JW 32170 CODE=ANS-(CODE*676)
EH 32180 HCODE=INT(CODE/26)
BH 32190 LCODE=CODE-(HCODE*26)+65
HB 32200 HCODE=HCODE+65
IE 32210 POSITION 0,16:? CHR$(HCODE);CHR$
   (LCODE)
VG 32220 POSITION 2,13:? "If CODE does no
   t match press  RETURN  and edit line a
   bove.":GOTO 32050
```

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ROULETTE, ATARI STYLE

Article on page 18

LISTING 1

Don't type the TYPO II Codes!

```
MV 2 REM ROULETTE
RR 4 REM BY MICHAEL PEMBERTON
QU 6 REM (c)1988, ANTIC PUBLISHING
IL 10 GRAPHICS 2:? #6:? #6:? #6:? #6;"
      ROULETTE":? :? :? #6;"              by":
   ? #6;"michael a□ pemberton"
QP 20 ? "            One Moment Please":? "
   Screen Will Go Blank For 10 Seconds"
WS 100 DIM COLR$(36),STR(38),STREET(12),L
   N6(11),BET$(370),SQRE(22),A$(1),SPLIT(
   58),COL(3),WHEEL(38)
VU 110 GRIDFIX=4110:CHECKCASH=4210:PLACEB
   ET=4310:ZERO=4470
EC 120 COLR$="RBRBRBRBRBBRBRBRBRRBRBRBRBR
   BBRBRBRBR"
SQ 130 REM BETTING MATRIX
JU 140 BET$(1,74)="■■■'eqfrgshhtiiujjvkkw
   llxmmynnzoo■pp■■%%■■*■-■0■■3■■6■■9■■<■
   ■?■■B■■E!!H$$d"
XQ 141 BET$(75,148)="■%%■J■L■N■PP■RR■TT■V
   V■XX■ZZ■\\■^^■■■■■aa■■>■,■/■■2■■5■■8■■
   ;■■>■■A■■D   G##c"
AS 142 BET$(149,222)="■&&■I■K■M■OO■QQ■SS■
   UU■WW■YY■[[■]]■__■■&&■■(■+■.■■1■■4■■7■
   ■:■■=■■e■■C■■FXXb"
XT 143 BET$(223,296)="■■■'eqfrgshhtiiujjv
   kkwllxmmynnzoo■pp■■■■■■■■■■■■■■■■■■■■■
   ■■■■■XXXXXXXXXXX■"
RW 144 BET$(297,370)="■■■■■■■■■■■■■■■■■■■■
   ■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■
   ■■■■■■■■■■■■■■■■■■■"
FV 145 BET$(220,220)=CHR$(34):BET$(221,22
   1)=CHR$(34):FOR X=285 TO 295:BET$(X,X)
   =CHR$(155):NEXT X
MS 146 FOR I=1 TO 38:READ X:WHEEL(I)=X:NE
   XT I
SA 150 REM CLEAR ARRAYS
XK 160 GOSUB 4470
AY 300 REM COLOR GAMEBOARD
LU 305 POKE 559,0
QH 310 FOR I=0 TO 3:POKE 53256+I,3:NEXT I
   :POKE 53260,1:I=PEEK(106):I=I-8:POKE 1
   06,I
RC 320 POKE 623,1:FOR J=0 TO 3:POKE 704+J
   ,54:NEXT J:POKE 54279,I:PMMEM=I*256
FH 350 FOR J=PMMEM TO PMMEM+2047:POKE J,0
   :NEXT J
HQ 370 FOR J=PMMEM+1061 TO PMMEM+1074:POK
   E J,207:POKE J+16,48:POKE J+32,204:POK
   E J+256,143:POKE J+272,112:NEXT J
YO 380 FOR J=PMMEM+1349 TO PMMEM+1362:POK
   E J,15:POKE J+224,199:POKE J+240,56:PO
   KE J+256,199:NEXT J
KN 390 FOR J=PMMEM+1829 TO PMMEM+1842:POK
   E J,227:POKE J+16,28:POKE J+32,3:NEXT
   J
RV 400 FOR J=PMMEM+805 TO PMMEM+818:POKE
   J,3:POKE J+32,3:NEXT J
UV 410 GRAPHICS 0:POKE 710,196:POKE 559,6
   2
VJ 420 POKE 53277,3
GP 430 POKE 53248,70:POKE 53249,102:POKE
   53250,134:POKE 53251,166:POKE 53252,19
   8
NX 440 REM GAME SETUP
XI 450 CASH=500:OLDNO=0
JR 460 HPOS=2:VPOS=0
SR 500 GOSUB 5010
WG 510 POSITION 2,12:? "CASH AVAILABLE: $
   ";CASH
TX 900 REM CURSOR MOVEMENT
TM 1000 POSITION HPOS+1,VPOS:? "■";
QW 1010 IF STICK(0)=14 THEN ? "■";:VPOS=V
   POS-1
OD 1020 IF STICK(0)=13 THEN ? "■";:VPOS=V
   POS+1
TA 1030 IF STICK(0)=7 THEN ? "■";:HPOS=HP
   OS+1
FA 1040 IF STICK(0)=11 THEN ? "■";:HPOS=H
   POS-1
DI 1045 IF VPOS<0 THEN VPOS=9:POSITION HP
   OS,8:? "■";
NJ 1047 IF VPOS>9 THEN VPOS=0:POSITION HP
   OS,1:? "■";
VW 1048 IF HPOS>38 THEN HPOS=2:POSITION 3
   ,VPOS:? "■";
XM 1049 IF HPOS<2 THEN HPOS=38:POSITION 3
   7,VPOS:? "■";
XX 1050 FOR I=1 TO 5:K=RND(0):NEXT I
JQ 1060 IF STRIG(0)=0 THEN X=PEEK(93):? "
   ■";:GOTO 1080
UY 1065 IF PEEK(53279)=6 THEN 2010
NW 1070 GOTO 1010
XH 1075 REM INTERPRET BETS
WU 1080 I=VPOS*37+HPOS-1:BET=ASC(BET$(I,I
   ))
KV 1085 IF BET=0 THEN ? "■":GOSUB 4110:?
   "■";:GOTO 1010
FI 1090 IF BET<39 THEN 1200
KD 1100 IF BET=39 THEN 1260
IU 1110 IF BET>39 AND BET<98 THEN 1310
PT 1120 IF BET>97 AND BET<101 THEN 1410
NR 1130 IF BET>100 AND BET<113 THEN 1440
YC 1140 IF BET>112 AND BET<125 THEN 1480
XA 1150 IF BET>124 AND BET<147 THEN 1520
KJ 1160 BET=BET-146:ON BET GOTO 1550,1560
   ,1570,1580,1590,1600,1610,1620,1630
FJ 1190 REM RECORD VARIOUS BETS
HS 1200 REM STRAIGHT BET
IM 1205 IF BET=37 THEN POSITION 2,15:? "■
   ■BET ON 0 (Y/N)";:GOSUB 4310:GOTO 1240
HA 1206 IF BET=38 THEN POSITION 2,15:? "■
   ■BET ON 00 (Y/N)";:GOSUB 4310:GOTO 124
   0
OG 1210 POSITION 2,15:? "■■BET ON ";BET;"
    (Y/N)";:GOSUB 4310
SZ 1240 STR(BET)=STR(BET)+AMT:GOTO 1000
OZ 1250 REM 5 LINE BET
UH 1260 POSITION 2,15:? "■■LINE BET (5) (
   Y/N)";:GOSUB 4310
RG 1290 LN5=LN5+AMT:GOTO 1000
AC 1300 REM SPLIT BET
GN 1310 POSITION 2,15:BET=BET-39
GN 1320 IF BET<34 THEN ? "■■SPLIT BET ON
   ";BET;",";BET+3;" (Y/N)";:GOTO 1360
FG 1330 IF BET=58 THEN ? "■■SPLIT BET ON
   0,00 (Y/N)";:GOTO 1360
MI 1340 J=BET-33:J=J+INT((J-1)/2)
DQ 1350 ? "■■SPLIT BET ON ";J;",";J+1;" (
   Y/N)";
AS 1360 GOSUB 4310
BH 1390 SPLIT(BET)=SPLIT(BET)+AMT:GOTO 10
   00
YM 1400 REM COLUMN BET
FZ 1410 POSITION 2,15:? "■■BET ON COLUMN
   ";BET-97;" (Y/N)";:GOSUB 4310
UL 1420 COL(BET-97)=COL(BET-97)+AMT:GOTO
   1000
BA 1430 REM STREET BET
KV 1440 BET=BET-100:POSITION 2,15:? "■■BE
   T ON STREET ";BET+2*BET-2;",";BET+2*BE
   T-1;",";BET+2*BET;" (Y/N)";
AR 1450 GOSUB 4310
IZ 1460 STREET(BET)=STREET(BET)+AMT:GOTO
   1000
PO 1470 REM LINE SIX BET
VO 1480 BET=BET-112:J=BET+(BET-1)*2:POSIT
   ION 2,15
DK 1485 ? "■■LINE BET ON ";J;",";J+1;",";
   J+2;",";J+3;",";J+4;",";J+5;" (Y/N)";
BD 1490 GOSUB 4310
```

```
GW 1500 LN6(BET)=LN6(BET)+AMT:GOTO 1000
XI 1510 REM SQUARE BET
BS 1520 BET=BET-124:J=BET+INT((BET-1)/2):POSITION 2,15:? "↑↑BET ON SQUARE ";J;",";J+1;",";J+3;",";J+4;" (Y/N)";
AN 1530 GOSUB 4310
VV 1540 SQRE(BET)=SQRE(BET)+AMT:GOTO 1000
UF 1550 POSITION 2,15:? "↑↑BET ON 19-36 (Y/N)";:GOSUB 4310:HI=HI+AMT:GOTO 1000
ZX 1560 POSITION 2,15:? "↑↑BET ON 1-18 (Y/N)";:GOSUB 4310:LO=LO+AMT:GOTO 1000
YC 1570 POSITION 2,15:? "↑↑BET ON ODD NUMBERS (Y/N)";:GOSUB 4310:ODD=ODD+AMT:GOTO 1000
VG 1580 POSITION 2,15:? "↑↑BET ON EVEN NUMBERS (Y/N)";:GOSUB 4310:EVEN=EVEN+AMT:GOTO 1000
XJ 1590 POSITION 2,15:? "↑↑BET ON RED NUMBERS (Y/N)";:GOSUB 4310:RED=RED+AMT:GOTO 1000
MM 1600 POSITION 2,15:? "↑↑BET ON BLACK NUMBERS (Y/N)";:GOSUB 4310:BLACK=BLACK+AMT:GOTO 1000
SU 1610 POSITION 2,15:? "↑↑BET ON 1ST DOZEN (Y/N)";:GOSUB 4310:DZN1=DZN1+AMT:GOTO 1000
XZ 1620 POSITION 2,15:? "↑↑BET ON 2ND DOZEN (Y/N)";:GOSUB 4310:DZN2=DZN2+AMT:GOTO 1000
JN 1630 POSITION 2,15:? "↑↑BET ON 3RD DOZEN (Y/N)";:GOSUB 4310:DZN3=DZN3+AMT:GOTO 1000
LA 2000 REM SPIN THE WHEEL
YD 2010 POSITION 2,12:? "↑↑↑↑↑↑";:POKE 752,1
BV 2020 X=INT(200*RND(0)):IF X<76 OR X>190 THEN 2020
WJ 2022 ? "WINNING NUMBER IS: ";
JQ 2024 FOR I=0 TO X-1:POSITION 21,12:J=((OLDNO+I)-38*INT((OLDNO+I)/38))+1:? "←←";
TY 2026 IF WHEEL(J)=37 THEN ? "0":GOTO 2032
WV 2028 IF WHEEL(J)=38 THEN ? "00":GOTO 2032
OF 2030 ? WHEEL(J)
MF 2032 FOR DELAY=1 TO 5:NEXT DELAY:NEXT I
TS 2040 NUM=WHEEL(J):OLDNO=J:POKE 752,0
VA 3000 REM CALCULATE WINNINGS
FX 3005 POSITION 2,14
DX 3010 REM STRAIGHTS
MK 3020 IF STR(NUM) THEN WIN=WIN+35*STR(NUM):CASH=CASH+STR(NUM):? "WIN STRAIGHT BET:";35*STR(NUM)
SD 3030 REM FIVE LINE
TY 3040 IF LN5 AND (NUM<4 OR NUM>36) THEN WIN=WIN+6*LN5:CASH=CASH+LN5:? "WIN LINE BET (5):";6*LN5
QB 3050 REM SPLITS
GV 3060 FOR I=1 TO 33
EC 3062 IF NOT (SPLIT(I) AND (NUM=I OR NUM=I+3)) THEN 3065
NI 3063 WIN=WIN+17*SPLIT(I):CASH=CASH+SPLIT(I):? "WIN SPLIT BET:";17*SPLIT(I)
GD 3065 NEXT I
GV 3067 FOR I=34 TO 57:J=I-33:J=J+INT((J-1)/2)
ZB 3070 IF NOT (SPLIT(I) AND (NUM=J OR NUM=J+1)) THEN 3072
ND 3071 WIN=WIN+17*SPLIT(I):CASH=CASH+SPLIT(I):? "WIN SPLIT BET:";17*SPLIT(I)
FU 3072 NEXT I
AH 3075 IF NOT (SPLIT(58) AND (NUM=37 OR NUM=38)) THEN 3090
JB 3077 WIN=WIN+17*SPLIT(58):CASH=CASH+SPLIT(58):? "WIN SPLIT:";17*SPLIT(58)
JM 3080 REM DROP OUT 0 AND 00
QG 3090 IF NUM>36 THEN 3410
HK 3100 REM COLUMNS
XK 3110 IF INT(NUM/3)=NUM/3 AND COL(3) THEN WIN=WIN+2*COL(3):CASH=CASH+COL(3):? "WIN COLUMN 3 BET:";2*COL(3)
YN 3120 IF INT((NUM+1)/3)=(NUM+1)/3 AND COL(2) THEN WIN=WIN+2*COL(2):CASH=CASH+COL(2):? "WIN COLUMN 2 BET:";2*COL(2)
LE 3130 IF INT((NUM+2)/3)=(NUM+2)/3 AND COL(1) THEN WIN=WIN+2*COL(1):CASH=CASH+COL(1):? "WIN COLUMN 1 BET:";2*COL(1)
KB 3140 REM STREETS
CJ 3150 STCNT=NUM:I=0
KI 3160 STCNT=STCNT-3:I=I+1:IF STCNT<1 THEN 3180
RV 3170 GOTO 3160
ZK 3180 IF STREET(I) THEN WIN=WIN+11*STREET(I):CASH=CASH+STREET(I):? "WIN STREET BET:";11*STREET(I)
DS 3190 REM SIX LINE
DZ 3200 FOR J=1 TO 11
MZ 3210 IF LN6(J) AND (I=J OR I=J+1) THEN WIN=WIN+5*LN6(J):CASH=CASH+LN6(J):? "WIN LINE BET:";5*LN6(J)
FM 3220 NEXT J
GM 3230 REM SQUARES
FK 3240 FOR I=1 TO 22
VI 3250 SQ=INT((I-1)/2)
DE 3260 IF SQRE(I) AND (NUM=I+SQ OR NUM=I+SQ+1 OR NUM=I+SQ+3 OR NUM=I+SQ+4) THEN GOSUB 4430
FQ 3270 NEXT I
KC 3280 REM HIGH/LOW
MG 3290 IF HI AND NUM>18 AND NUM<37 THEN WIN=WIN+HI:CASH=CASH+HI:? "WIN 19-36 BET:";HI
WL 3300 IF LO AND NUM<19 THEN WIN=WIN+LO:CASH=CASH+LO:? "WIN 1-18 BET:";LO
BQ 3310 REM ODD/EVEN
CX 3320 IF ODD AND INT(NUM/2)<NUM/2 THEN WIN=WIN+ODD:CASH=CASH+ODD:? "WIN ODD BET:";ODD
IM 3330 IF EVEN AND INT(NUM/2)=NUM/2 THEN WIN=WIN+EVEN:CASH=CASH+EVEN:? "WIN EVEN BET:";EVEN
MX 3340 REM BLACK/RED
DN 3350 IF RED AND COLR$(NUM,NUM)="R" THEN WIN=WIN+RED:CASH=CASH+RED:? "WIN RED BET:";RED
FK 3360 IF BLACK AND COLR$(NUM,NUM)="B" THEN WIN=WIN+BLACK:CASH=CASH+BLACK:? "WIN BLACK BET:";BLACK
LO 3370 REM DOZENS
LX 3380 IF DZN1 AND NUM<13 THEN WIN=WIN+2*DZN1:CASH=CASH+DZN1:? "WIN 1ST DOZEN BET:";2*DZN1
EM 3390 IF DZN2 AND NUM>11 AND NUM<25 THEN WIN=WIN+2*DZN2:CASH=CASH+DZN2:? "WIN 2ND DOZEN BET:";2*DZN2
PY 3400 IF DZN3 AND NUM>24 THEN WIN=WIN+2*DZN3:CASH=CASH+DZN3:? "WIN 3RD DOZEN BET:";2*DZN3
EA 3410 GOSUB 4470
PO 3500 REM DISPLAY WINNINGS
SW 3510 ? "CASH=";CASH;"  WINNINGS=";WIN
ML 3520 CASH=CASH+WIN:WIN=0:IF CASH=0 THEN 4400
BM 3530 ? "PRESS RETURN TO CONTINUE":? "OR ENTER 'Q' TO QUIT";:INPUT A$
KB 3540 IF A$<>"Q" THEN 500
OF 3550 IF CASH>500 THEN ? :? "CONGRATULATIONS. YOU WON $";CASH-500:END
DO 3560 IF CASH<500 THEN ? :? "SORRY. YOU LOST $";500-CASH:END
RH 3570 ? :? "YOU BROKE EVEN. IT COULD BE WORSE.":END
RS 4100 REM GRIDFIX SUBROUTINE
NJ 4110 IF X>64 AND X<91 THEN X=X-64:GOTO 4130
XJ 4120 IF X<64 THEN X=X+32
NJ 4130 POSITION HPOS,VPOS:? CHR$(X);:RETURN
ON 4200 REM CHECK CASH SUBROUTINE
GN 4210 IF CASH-AMT<0 THEN ? "⊠NOT ENOUGH MONEY":GOSUB 4110:GOTO 4230
AN 4220 CASH=CASH-AMT:POSITION 2,12:? "CASH AVAILABLE: $      ←←←←←";CASH
AP 4230 RETURN
MX 4300 REM PLACE BET SUBROUTINE
QO 4305 TRAP 4520
WF 4310 INPUT A$:IF A$<>"Y" THEN GOSUB 4110:? "←";:GOTO 1010
SI 4320 ? "AMOUNT";:INPUT AMT:IF AMT=0 THEN GOSUB 4110:? "←";:GOTO 1010
ZZ 4330 GOSUB 4210
AU 4340 RETURN
UJ 4400 REM GONE BROKE
CV 4410 ? "SORRY, YOU'RE BROKE":? "▶TRY AGAIN (Y/N)";:INPUT A$:IF A$="Y" THEN 440
FE 4420 END
UU 4430 REM SQUARE WIN SUBROUTINE
AI 4440 WIN=WIN+8*SQRE(I):CASH=CASH+SQRE(
```

continued on next page

```
   I):? "WIN SQUARE BET:";8*SQRE(I)
AZ 4450 RETURN
BY 4460 REM ZERO ALL BETS
QV 4470 HI=0:LO=0:ODD=0:EVEN=0:BLACK=0:RE
   D=0:DZN1=0:DZN2=0:DZN3=0:COL(1)=0:COL(
   2)=0:COL(3)=0:LN5=0
WV 4480 FOR I=1 TO 38:STR(I)=0:NEXT I:FOR
    I=1 TO 12:STREET(I)=0:NEXT I:FOR I=1
   TO 11:LN6(I)=0:NEXT I
QX 4490 FOR I=1 TO 22:SQRE(I)=0:NEXT I:FO
   R I=1 TO 58:SPLIT(I)=0:NEXT I
AM 4500 RETURN
DK 4510 REM INPUT ERROR
JD 4520 POP :GOSUB 4110:GOTO 1000
QI 5000 REM DRAW BOARD
BL 5010 ? "[graphics]":POSITION 2,0:? "[graphics]
   [graphics] |  |3|6|9|1
   2|15|18|21|24|27|30|33|36|"
CM 5020 POSITION 2,2:? "| 0[graphics]
   [graphics] [graphics]2|5|8|11|14|1
   7|20|23|26|29|32|35|"
AH 5030 POSITION 2,4:? "|00[graphics]
   [graphics] |  |1|4|7|10|13|1
   6|19|22|25|28|31|34|"
MB 5040 POSITION 2,6:? "[graphics]
   [graphics]      | 1ST 12 |  2N
   D 12   |  3RD 12   |"
NU 5050 POSITION 2,8:? "   [graphics]
   [graphics]      |1-18|EVN| RED
    |BLACK| ODD |19-36|"
NA 5060 POSITION 2,10:? "   [graphics]
   [graphics]":RETURN
FA 6130 REM WHEEL CONFIGURATION
QT 6140 DATA 38,27,10,25,29,12,8,19,31,18
   ,6,21,33,16,4,23,35,14,2,37,28,9,26,30
NX 6150 DATA 11,7,20,32,17,5,22,34,15,3,2
   4,36,13,1
```

LISTING 2

```
QP 10 REM ROULETTE, LISTING 2
IL 20 REM BY MICHAEL PEMBERTON
QH 30 REM (c)1988, ANTIC PUBLISHING
OD 35 REM CREATES LINES 140-144
EV 40 REM (LINES 10-250 MAY BE USED WITH
   OTHER BASIC LOADERS IN THIS ISSUE.
IJ 50 REM CHANGE LINE 70 AS NECESSARY.)
PR 60 DIM FN$(20),TEMP$(20),AR$(93):DPL=P
   EEK(10592):POKE 10592,255
WO 70 FN$="D:LINES.LST":REM THIS IS THE N
   AME OF THE DISK FILE TO BE CREATED
RD 80 ? "[D]isk or [C]assette?";:POKE 764,25
   5
PY 90 IF  NOT (PEEK(764)=18 OR PEEK(764)=
   58) THEN 90
TH 100 IF PEEK(764)=18 THEN FN$="C:"
VB 110 POKE 764,255:GRAPHICS 0:? "      AN
   TIC'S GENERIC BASIC LOADER"
MY 120 ? ,"BY CHARLES JACKSON"
KB 130 POKE 10592,DPL:TRAP 200
PU 140 ? :? :? "Creating ";FN$:? "...Plea
   se stand by."
LW 150 RESTORE :READ LN:LM=LN:DIM A$(LN):
   C=1
BQ 160 AR$="":READ AR$
YC 170 FOR X=1 TO LEN(AR$) STEP 3:POKE 75
   2,255
DM 180 LM=LM-1:POSITION 10,10:? "(Countdo
   wn...T-";INT(LM/10);")    "
BK 190 A$(C,C)=CHR$(VAL(AR$(X,X+2))):C=C+
   1:NEXT X:GOTO 160
MM 200 IF PEEK(195)=5 THEN ? :? :? "[T]OO
   MANY DATA LINES!":? "CANNOT CREATE FIL
   E!":END
CM 210 IF C<LN+1 THEN ? :? "[T]OO FEW DATA
    LINES!":? "CANNOT CREATE FILE!":END
UQ 220 IF FN$="C:" THEN ? :? " Prepare ca
   ssette, press [RETURN]"
AR 230 OPEN #1,8,0,FN$
PV 240 POKE 766,1:? #1;A$;:POKE 766,0
AL 250 CLOSE #1:GRAPHICS 0:? "COMPLETED
   "
IK 1000 DATA 471
WO 1010 DATA 0490520480320660690840360400
   4904405505204106103400000000003910111З
   1021141031151041041161051O5
PN 1020 DATA 1171061061181071071191081081
   2010910912111011012211111112311211200O
   000037037000003042006045009
JM 1030 DATA 0480120120510150150540180180
   57021021060024024063027027066030030069
   033033072036036100034155049
GH 1040 DATA 0520490320660690840360400550
   53044049052056041061034000037037000074
   126076128078130080080132082
PW 1050 DATA 0821340840841360860861380880
   88140090090142092092144094094146096096
   000000097097000002041005044
LG 1060 DATA 0080470110110500140140530170
   17056020020059023023062026026065029029
   068032032071035035099034155
LS 1070 DATA 0490520500320660690840360400
   49052057044050050050041061034000038038
   000073125075127077129079079
IP 1080 DATA 1310810811330830831350850851
   37087087139089089141091091143093093145
   095095000000038038000001040
UZ 1090 DATA 0040430070460100100490130130
   52016016055019019058022022061025025064
   028028067031031070088088098
MR 1100 DATA 0341550490520510320660690840
   36040050050051044050057054041061034000
   000000039101113102114103115
EC 1110 DATA 1041041161051051171061061181
   07107119108108120109109121110110122111
   111123112112000000000000000
HQ 1120 DATA 1531531531531531531531530001
   54154154154154154154154154154000088
   088088088088088088088088088
DD 1130 DATA 0880000341550490520520320660
   69084036040050057055044051055048041061
   034000000000000000000000000
ZN 1140 DATA 0000000000000000000000000000
   000000000000000000000000000000000000
   000000000000000000000000000
CN 1150 DATA 0000001481481481480001501501
   50000151151151151151000152152152152152
   000149149149149149000147147
AY 1160 DATA 147147147000034155
```

AN ATARI GROWS ORCHIDS IN TEXAS

REAL-WORLD INTERFACE

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LISTING 1

Don't type the TYPO II Codes!

```
HT 1 REM REAL-WORLD INTERFACE
PL 2 REM BY JOHN W. LITTLE
QR 3 REM (c)1988, ANTIC PUBLISHING
DN 5 A800=0:REM CHANGE TO A 1 FOR PORTB O
   N AN ATARI 400/800
VG 6 IF  NOT (A800=0 OR A800=1) THEN ? "T
   YPING ERROR LINE 5![ ]":END
BN 10 GRAPHICS 2+16:? #6:? #6:? #6;"     R
   EAL":? #6:? #6;"     WORLD":? #6:? #6;"
        INTERFACE"
LC 12 RESTORE 7000:FOR X=1664 TO 1761:REA
   D BYTE:POKE X,BYTE:NEXT X:X=USR(1664)
QS 20 POKE 752,1:REM KILL CURSOR
KB 30 REM DECLARATIONS
GM 50 DIM YN$(1):LET ON=0:OFF=1
XY 60 PORTA=54016:PACTL=54018:ORIG=PEEK(5
   4018+A800):CONSOL=53279
NB 80 REM INITIALIZE CLOCK
GR 100 ? "[ ]":POSITION 4,2:? "DO YOU WISH
    TO RESET THE CLOCK";:YN$=" ":INPUT YN$
```

```
IN 110 IF ASC(YN$)<>89 THEN IF ASC(YN$)<>
   121 THEN 130:REM Y OR y
NN 120 GOTO 150
OZ 130 IF ASC(YN$)<>78 THEN IF ASC(YN$)<>
   110 THEN 100:REM N or n
MI 140 GOTO 300
MO 150 ? "▣":POSITION 11,2:? "SET REALTIM
   E CLOCK":? :? :?
CV 160 HOUR=0:MIN=0:SEC=0
YL 170 ? "Correct Hour(0-23)";:TRAP 180:I
   NPUT HOUR:?
AW 180 ? "Correct Minute";:TRAP 190:INPUT
    MIN:?
RQ 190 ? "Correct Second";:TRAP 200:INPUT
    SEC
AL 200 ? "▣":POSITION 13,2:? "REALTIME CL
   OCK"
JB 210 POSITION 9,23:? "Press START to co
   ntinue"
HT 220 POKE 18,MIN:POKE 19,SEC:POKE 20,0:
   POKE 209,0:POKE 208,0:POKE 207,HOUR:X=
   USR(1664)
OY 224 REM DISPLAY CLOCK
GV 230 POSITION 16,10:POKE 752,1
PQ 231 T=PEEK(207):IF T>9 THEN ? T;:? ":"
   ;:GOTO 233
VF 232 ? "0";:? T;:? ":";
VL 233 T=PEEK(18):IF T>9 THEN ? T;:? ":";
   :GOTO 235
VL 234 ? "0";:? T;:? ":";
WN 235 T=PEEK(19):IF T>9 THEN ? T:GOTO 24
   0
BT 236 ? "0";:? T
XR 240 IF PEEK(CONSOL)=7 THEN 230
QJ 270 REM MAIN PROGRAM
PB 300 ? "▣":POKE 710,0:POKE 82,1:REM SET
    UP SCREEN
EO 320 REM CONFIG. PORT FOR OUTPUT
OP 340 POKE PACTL+A800,ORIG-4:POKE PORTA+
   A800,255:POKE PACTL+A800,ORIG
TJ 360 REM GET TIMING PARAMETERS
XV 380 GOSUB 880
JP 390 IF TIMEON=0 THEN 1260:REM MANUAL O
   PERATION
RK 400 GOSUB 1110
YH 403 REM START TIMING
VN 410 POSITION 5,23:? "Press any key to
   begin timing";:POKE 764,255:POKE 752,1
KC 411 IF PEEK(764)=255 THEN GOSUB 840:GO
   SUB 1410:GOTO 411
NK 412 POSITION 5,23:? "
                      ";
HR 420 REM IS CURRENT TIME BETWEEN EARLIE
   ST AND LATEST START TIMES?
YA 440 IF EARLYHOUR>PEEK(207) THEN GOSUB
   1410:GOSUB 840:GOTO 440
UZ 450 IF LATEHOUR>PEEK(207) THEN 500
TC 460 GOSUB 840:GOSUB 1410:GOTO 440
TH 480 REM RELAY OPERATION LOOP
NF 500 LET ONOFF=ON:SEC=SECON:MIN=MINON:H
   R=HRON:GOSUB 600
EL 510 LET ONOFF=OFF:SEC=SECOFF:MIN=MINOF
   F:HR=HROFF:GOSUB 600
OK 520 GOTO 440
DX 580 REM TIMING SUBROUTINE
ZU 600 STARTMINS=PEEK(18):STARTSECS=PEEK(
   19):STARTHOUR=PEEK(207):REM GET CURREN
   T TIME
QB 610 POKE PORTA+A800,ONOFF:REM CLOSE OR
    OPEN RELAY
TO 620 REM ADJUST COUNTER IF #OF SECS TO
   COUNT + #OF SECS CURRENTLY ON CLOCK >
   59
EG 640 IF SEC+STARTSECS>59 THEN STARTMINS
   =STARTMINS+1:LET ENDSEC=SEC+STARTSECS-
   60:GOTO 690
GX 650 LET ENDSEC=SEC+STARTSECS
TY 670 REM ADJUST COUNTER IF #OF SECS TO
   COUNT + #OF SECS CURRENTLY ON CLOCK >
   59
UN 690 IF MIN+STARTMINS>59 THEN STARTHOUR
   =STARTHOUR+1:LET ENDMIN=MIN+STARTMINS-
   60:GOTO 705
BX 700 LET ENDMIN=MIN+STARTMINS
SS 705 LET ENDHOUR=HR+STARTHOUR
RD 710 IF ENDHOUR<24 THEN 770
JN 720 LET ENDHOUR=ENDHOUR-24
LE 729 REM WAIT FOR CURRENT HOUR TO CROSS
    MIDNIGHT AND BECOME "0".
RL 730 IF PEEK(207)>ENDHOUR THEN GOSUB 84
   0:GOSUB 1410:GOTO 730
RP 750 REM WAIT FOR HOURS, MINS, SECS TO
   COUNT DOWN
OP 770 GOSUB 840:IF PEEK(CONSOL)<7 THEN 1
   410
WP 780 IF ENDHOUR>PEEK(207) THEN 770
OT 790 GOSUB 840:IF PEEK(CONSOL)<7 THEN 1
   410
AO 800 IF ENDMIN>PEEK(18) THEN 790
OE 810 GOSUB 840:IF PEEK(CONSOL)<7 THEN 1
   410
OP 820 IF ENDSEC>PEEK(19) THEN 810
ZK 830 RETURN
PX 835 REM DISPLAY TIME
QH 840 POSITION 16,1
CJ 841 T=PEEK(207):IF T>9 THEN ? T;:? ":"
   ;:GOTO 843
VN 842 ? "0";:? T;:? ":";
HX 843 T=PEEK(18):IF T>9 THEN ? T;:? ":";
   :GOTO 845
VT 844 ? "0";:? T;:? ":";
PW 845 T=PEEK(19):IF T>9 THEN ? T:GOTO 84
   7
CB 846 ? "0";:? T
AH 847 RETURN
BG 860 REM INPUT DATA SUBROUTINES
JB 880 POSITION 1,6:? "------------------
   --------------------"
RE 881 POSITION 7,7:? "PRESS RETURN TO DI
   SREGARD.":?
KN 882 POSITION 1,8:? "------------------
   --------------------"
PJ 890 TRAP 940
CR 900 ? "EARLIEST HOUR TO TURN WATER ON"
   ;:INPUT EARLYHOUR
OJ 910 TRAP 930
FA 920 ? "LATEST HOUR TO TURN WATER ON";:
   INPUT LATEHOUR:GOTO 980
AO 930 ? "◙":? "▣":GOTO 880
SM 940 EARLYHOUR=0:LATEHOUR=24
KT 950 ? "▣":POSITION 1,2:? "------------
   --------------------------"
KT 960 POSITION 1,3:? "■ NO EARLIEST AND
   LATEST START TIMES ■"
EN 970 ? "--------------------------------
   -------":GOTO 1010
CE 980 ? "▣":POSITION 1,2:? "------------
   ---------------------------":POSITION 1
   ,3:? "■EARLIEST START:";EARLYHOUR;
GL 990 POSITION 20,3:? "■ LATEST START:";
   LATEHOUR;" ■"
EK 1000 ? "------------------------------
   ---------"
HU 1010 ? :? "PRESS RETURN 3 TIMES TO BYP
   ASS TIMER.":?
LG 1020 HRON=0:MINON=0:SECON=0
MT 1021 TRAP 1030
IL 1022 ? "NUMBER OF HOURS WATER WILL BE
   ON";
MW 1023 INPUT HRON
OF 1030 TRAP 1060
HX 1040 ? "NUMBER OF MINUTES WATER WILL B
   E ON";
GP 1050 INPUT MINON
QB 1060 TRAP 1090
PJ 1070 ? "NUMBER OF SECONDS WATER WILL B
   E ON";
BU 1080 INPUT SECON
VA 1090 TIMEON=HRON+MINON+SECON:REM For t
   est in line 390
AB 1100 RETURN
PQ 1110 HROFF=0:MINOFF=0:SECOFF=0
MR 1111 TRAP 1120
UN 1112 ? :? "NUMBER OF HOURS WATER WILL
   BE OFF";
ZH 1113 INPUT HROFF
OD 1120 TRAP 1150
KH 1130 ? "NUMBER OF MINUTES WATER WILL B
   E OFF";
VK 1140 INPUT MINOFF
PZ 1150 TRAP 1180
RT 1160 ? "NUMBER OF SECONDS WATER WILL B
   E OFF";
QP 1170 INPUT SECOFF
HV 1180 TIMEOFF=HROFF+MINOFF+SECOFF:REM F
   or test in line 1190
PR 1190 IF TIMEOFF=0 THEN ? "◙";"▣":? "Yo
   u must specify an 'OFF' period in    o
   rder to use the timer.":POP :GOTO 380
JA 1200 ? :? "OPTION TO STOP CYCLE WITH W
```

continued on next page

```
   ATER ON.":? "SELECT TO STOP CYCLE WITH
    WATER OFF."
IP 1210 ? "START TO RE-START PROGRAM":? "
   WITHOUT RESETTING CLOCK."
AJ 1220 RETURN
SQ 1240 REM MANUAL ON/OFF ROUTINES
PX 1260 LET ONOFF=ON
QG 1270 TRAP 1270
GB 1280 ? :? "Do you wish to turn the wat
   er on";
BT 1290 GOSUB 1350
MM 1300 TRAP 1300
GQ 1310 LET ONOFF=OFF
IM 1320 ? "Do you wish to turn the water
   off";
BD 1330 GOSUB 1350
DY 1340 GRAPHICS 0:END
FC 1350 YN$=" ":INPUT YN$
IT 1360 IF ASC(YN$)<>89 THEN IF ASC(YN$)<
   >121 THEN 1390:REM Y OR y
WC 1370 POKE PORTA+A800,ONOFF
BD 1380 RETURN
DF 1390 IF ASC(YN$)<>78 THEN IF ASC(YN$)<
   >110 THEN POP :GOTO 65536:REM N or n..
   .65536 IS ERROR TO TRAP
AH 1400 RETURN
MF 1405 REM EARLY EXIT
LJ 1410 IF PEEK(CONSOL)=3 THEN POKE PORTA
   +A800,ON:POP :POSITION 1,20:POKE 752,0
   :END
AL 1420 IF PEEK(CONSOL)=5 THEN POKE PORTA
   +A800,OFF:POP :POSITION 1,20:POKE 752,
   0:END
YP 1430 IF PEEK(CONSOL)=6 THEN POP :GOTO
   300
AT 1440 RETURN
CJ 7000 DATA 104,162,6,160,139,169,7,32,9
   2,228,96,230,208,208,2,230,209,165,208
   ,201,15,144,26,165,209
WX 7010 DATA 201,3,144,20,169,0,133,208,1
   33,209,165,20,201,60,144,6,169,1,133,2
   0,208,12,230,20,165
QT 7020 DATA 20,201,60,144,40,169,0,133,2
   0,230,19,165,19,201,60,144,28,169,0,13
   3,19,230,18,165,18
RY 7030 DATA 201,60,144,16,169,0,133,18,2
   30,207,165,207,201,24,144,4,169,0,133,
   207,76,98,228
```

SHADOWS AND REFLECTIONS FOR YOUR 8-BIT GRAPHICS

HARD-WIRED RAY TRACING

Article on page 41

LISTING 1

Don't type the TYPO II Codes!

```
JW 10 REM HARD-WIRED RAY TRACING
VQ 20 REM BY MICHAEL BJORKMAN
QH 30 REM (c)1988, ANTIC PUBLISHING
ZP 40 BRKX=(PEEK(53279)<>3)
CP 1000 GOSUB 1660
BG 1010 FOR SY=1 TO 191
MW 1020 FOR SX=0.5 TO 318.5 STEP 2
MN 1030 TRAP 1340:SXSCR=(SX-0.5)/2:SYSCR=
   SY
JG 1040 POKE 559,0:IF PEEK(53279)=3 THEN
   POKE 559,OLDVALUE
TP 1050 REM SPHERE PIXEL?
BG 1060 A1=(SX-VX)*(SX-VX)+(SY-VY)*(SY-VY
   )+VZ*VZ
HX 1070 B1=2*((SX-VX)*(VX-CX)+(SY-VY)*(VY
   -CY)-VZ*(VZ-CZ))
DC 1080 C1=(VX-CX)*(VX-CX)+(VY-CY)*(VY-CY
   )+(VZ-CZ)*(VZ-CZ)-R*R
PA 1090 ARG=B1*B1-4*A1*C1:IF ARG<=0 THEN
   1250
RU 1100 REM SPHERE PIXEL
ZW 1110 SCALE1=(-B1+SQR(ARG))/(2*A1)
UC 1120 DX=SCALE1*(SX-VX):DY=SCALE1*(SY-V
   Y):DZ=-SCALE1*VZ
GO 1130 RX=DX+VX-CX:RY=DY+VY-CY:RZ=DZ+VZ-
   CZ
KC 1140 DDOTN=(DX*RX+DY*RY+DZ*RZ)/R
GH 1150 SCALE2=(191-CY-RY)/(DY+2*DDOTN*RY
   /R)
EH 1160 IF SCALE2>=0 THEN 1220
MQ 1170 REM REFLECTED RAY INTERSECTS ROOF
CF 1180 SCALE2=(0-CY-RY)/(DY+2*DDOTN*RY/R
   )
PP 1190 DHTEMP=DHROF:SMTEMPLO=SMROFLO:SMT
   EMPHI=SMROFHI
WF 1200 GOSUB 1420:GOTO 1330
XW 1210 REM REFLECTED RAY INTERSECTS FLOO
   R
GR 1220 DHTEMP=DHFLR:SMTEMPLO=SMFLRLO:SMT
   EMPHI=SMFLRHI
WO 1230 GOSUB 1420:GOTO 1330
KV 1240 REM NOT SPHERE PIXEL
VF 1250 DX=SX-VX:DY=SY-VY:DZ=-VZ
NG 1260 IF SY<=HORIZON THEN 1300
DO 1270 A=(191-VY)/DY:REM BELOW HORIZON
HJ 1280 DHTEMP=DHFLR:SMTEMPLO=SMFLRLO:SMT
   EMPHI=SMFLRHI
ZJ 1290 GOSUB 1550:GOTO 1330
VP 1300 A=(0-VY)/DY:REM ABOVE HORIZON
OV 1310 DHTEMP=DHROF:SMTEMPLO=SMROFLO:SMT
   EMPHI=SMROFHI
CA 1320 GOSUB 1550
NS 1330 POKE 77,0:REM KILL ATTRACT MODE
YD 1340 NEXT SX
YS 1350 NEXT SY
DQ 1360 REM SAVE SCREEN
LK 1370 LOD$(3,3)=CHR$(11)
MR 1380 SLOC=PEEK(88)+PEEK(89)*256:CLOSE
   #1:OPEN #1,8,0,"D:TRACE.PIC":GOSUB 800
   0
HM 1390 X=USR(ADR(LOD$),SLOC,7680):PUT #1
   ,PEEK(712):FOR X=708 TO 710:PUT #1,PEE
   K(X):NEXT X:CLOSE #1
ST 1400 GRAPHICS 0:? "DONE!":END
FP 1410 REM REFLECTION ROUTINE
CJ 1420 DRX=DX-2*DDOTN*RX/R:DRY=DY-2*DDOT
   N*RY/R:DRZ=DZ-2*DDOTN*RZ/R
NS 1430 FX=CX+RX+SCALE2*DRX+FXDISP:FY=CY+
   RY+SCALE2*DRY:FZ=CZ+RZ+SCALE2*DRZ+FZDI
   SP
UU 1440 FXSCR=((FX-INT(FX/318.5)*318.5)-0
   .5)/2:FZSCR=191-(FZ-INT(FZ/191)*191)
KL 1450 IF FXSCR<=0 THEN FXSCR=0
PZ 1460 IF FXSCR>=160 THEN FXSCR=160
NH 1470 IF FZSCR<=0 THEN FZSCR=0
AP 1480 IF FZSCR>=191 THEN FZSCR=191
VO 1490 POKE 561,DHTEMP:POKE 88,SMTEMPLO:
   POKE 89,SMTEMPHI
SC 1500 LOCATE FXSCR,FZSCR,BYTE
EQ 1510 POKE 561,DHSCR:POKE 88,SMSCRLO:PO
   KE 89,SMSCRHI
JY 1520 IF YDM THEN BYTE=BYTE-1:IF BYTE<=
   0 THEN BYTE=0
MQ 1530 COLOR BYTE:PLOT SXSCR,SYSCR:FLAG=
   1:RETURN
GO 1540 REM FLOOR OR CEILING ROUTINE
RP 1550 FX=VX+A*DX+FXDISP:FY=VY+A*DY:FZ=V
   Z+A*DZ+FZDISP
VC 1560 FXSCR=((FX-INT(FX/318.5)*318.5)-0
   .5)/2:FZSCR=191-(FZ-INT(FZ/191)*191)
KT 1570 IF FXSCR<=0 THEN FXSCR=0
QH 1580 IF FXSCR>=160 THEN FXSCR=160
NP 1590 IF FZSCR<=0 THEN FZSCR=0
ZV 1600 IF FZSCR>=191 THEN FZSCR=191
UU 1610 POKE 561,DHTEMP:POKE 88,SMTEMPLO:
   POKE 89,SMTEMPHI
SK 1620 LOCATE FXSCR,FZSCR,BYTE
EY 1630 POKE 561,DHSCR:POKE 88,SMSCRLO:PO
   KE 89,SMSCRHI
AV 1640 COLOR BYTE:PLOT SXSCR,SYSCR:RETUR
   N
```

```
LB 1650 REM ENTER VIEWPOINT COORDINATES
YK 1660 GOSUB 7500:TRAP 1690:VX=160:VY=96
   :VZ=-450
PJ 1665 POSITION 8,5:? " Viewpoint Coordi
   nates:":POSITION 7,6:? "(Where are you
   standing?)"
HT 1670 ? :? "Input VX,VY,VZ:":? " 0<VX<3
   19":? " 0<VY<191":? " VZ<0":GOSUB 8000

JQ 1680 INPUT VX,VY,VZ
MT 1690 IF VX<0 OR VX>319 OR VY<0 OR VY>1
   91 OR VZ>0 THEN ? "Coord Error██":GOTO
    1660
VP 1700 REM SPHERE COORDINATES
AW 1705 TRAP 1740:CX=107:CY=64:CZ=95.5
MX 1710 GOSUB 7500:POSITION 3,5:? "Where
   is the center of the sphere?"
ZZ 1715 POSITION 13,7:? "( CX, CY & CZ )"
   :?
CD 1720 INPUT CX,CY,CZ
TP 1730 REM CIRCLE RADIUS
DD 1740 R=INT(CY/2):TRAP 1760:? "███
   Radius of the Sphere":? :? "(0-";CY;")
   ";
TJ 1750 INPUT R
QE 1760 TRAP 1800:IF CY-R<0 OR CY+R>191 T
   HEN ? "Coord Error██":GOTO 1705
QV 1770 FXDISP=0:FZDISP=0:GOSUB 7500:POSI
   TION 8,5:? "Input FXDISP, FZDISP:":?
FC 1780 INPUT FXDISP,FZDISP
VX 1790 REM READ .PIC FILE
ZN 1800 TRAP 40000:PICSIZE=7680:GOSUB 218
   0:REM INIT ML LOADER
YO 1810 DIM J$(18),FILE$(18),FNAMFLR$(18)
   ,FNAMROF$(18),MILOD$(342)
LF 1812 ? "███ Use the DIMMING Feature(
   Y/N)";:INPUT J$:IF  NOT (J$="Y" OR J$=
   "y" OR J$="n" OR J$="N") THEN 1812
RG 1814 YDM=0:IF J$="Y" OR J$="y" THEN YD
   M=1
NI 1820 ? "█   FLOOR FILENAME"
YV 1830 GOSUB 2110
YK 1840 FNAMFLR$=FILE$
WO 1850 ? "█   CEILING FILENAME"
ZE 1860 GOSUB 2110
ZC 1870 FNAMROF$=FILE$
BU 1880 REM LOAD FLOOR
HS 1890 POKE 106,PEEK(740):MEMTOP=PEEK(10
   6)
TI 1900 GRAPHICS 15+16:GOSUB 8000:DHFLR=P
   EEK(561)
RS 1910 SMFLRLO=PEEK(88):SMFLRHI=PEEK(89)
   :SMFLR=SMFLRLO+256*SMFLRHI:POKE 559,34

GA 1920 CLOSE #1:OPEN #1,6,0,FNAMFLR$:INP
   UT #1,MILOD$:CLOSE #1
HS 1921 OPEN #1,4,0,FNAMFLR$:IF MILOD$(15
   ,17)="062" THEN 1926
DE 1925 GOSUB 7000:CLOSE #1:GOTO 1940
YA 1926 X=USR(ADR(LOD$),SMFLR,PICSIZE):CL
   OSE #1
VX 1930 REM LOAD ROOF
GU 1940 POKE 106,MEMTOP-32
XA 1950 GRAPHICS 15+16:GOSUB 8000:DHROF=P
   EEK(561)
JJ 1960 SMROFLO=PEEK(88):SMROFHI=PEEK(89)
   :SMROF=SMROFLO+256*SMROFHI:POKE 559,34

JJ 1970 CLOSE #1:OPEN #1,6,0,FNAMROF$:INP
   UT #1,MILOD$:CLOSE #1
UZ 1971 OPEN #1,4,0,FNAMROF$:IF MILOD$(15
   ,17)="062" THEN 1976
KC 1975 GOSUB 7000:CLOSE #1:GOTO 1990
AO 1976 X=USR(ADR(LOD$),SMROF,PICSIZE):CL
   OSE #1
LL 1980 REM ESTABLISH PLOTTING SCREEN
LR 1990 POKE 106,MEMTOP-64
XO 2000 GRAPHICS 15+16:GOSUB 8000:DHSCR=P
   EEK(561)
RM 2010 SMSCRLO=PEEK(88):SMSCRHI=PEEK(89)
   :SMSCR=SMSCRLO+256*SMSCRHI:POKE 559,34

HN 2020 HORIZON=VY
QS 2030 REM SET COLORS
HE 2040 SETCOLOR 4,0,0
HX 2050 SETCOLOR 0,0,4
LN 2060 SETCOLOR 1,0,8
TO 2070 SETCOLOR 2,0,12
LS 2080 OLDVALUE=PEEK(559)
BB 2090 RETURN
AP 2100 REM GET PIC FILENAME
TD 2110 CLOSE #1:POKE 710,0:POKE 709,40:?
    "Insert disk into drive #1,"
YU 2120 ? " press <return>";:INPUT J$:OPE
   N #1,6,0,"D:*.?IC"
UI 2130 ? "█":TRAP 2140:FOR N=0 TO 63:INP
   UT #1,FILE$:POSITION 2+19*((N/2)=INT(N
   /2)),INT(N/2):? FILE$;:NEXT N
LK 2140 TRAP 2110:POP :CLOSE #1:? :? "Ent
   er Filename";:INPUT FILE$
PD 2150 IF FILE$(1,2)<>"D:" AND FILE$(1,3
   )<>"D1:" AND FILE$(1,3)<>"D2:" THEN J$
   =FILE$:FILE$(1,2)="D:":FILE$(3)=J$
AK 2160 TRAP 2240:RETURN
VM 2170 REM ML SCREEN LOAD ROUTINE
HN 2180 DIM LOD$(28)
VJ 2190 LOD$="h██R█h█U█h█T█h█Y█h█X███ V█
   █"
AE 2200 RETURN
ZA 2230 REM ERROR MESSAGE
OZ 2240 ? "DISK ERROR":END
PI 7000 REM LOAD AN MI PICTURE
OC 7020 RESTORE 7060
LI 7030 FOR A=1536 TO 1556
WN 7040 READ B:POKE A,B
CA 7050 NEXT A
WC 7060 DATA 162,16,169,1,157,72,3,169,0,
   157,73,3,32,86,228,48,1,96,104,104,96
CE 7070 MILOD$="h███N█B██h█D████E███H███
   ████████████████████<█████"
LY 7080 MILOD$(55)="██████████D████ ██████E
   ██ ████F███ ████G███ ████H███D████
   █"
LE 7090 MILOD$(115)="██X█████Y████ ███████^
   ████████K█████ ██████ ███████ ████████
   █"
KC 7100 MILOD$(175)="███████/F███████████
   E█P█?  ███████████E█P█████E█P█P"
DR 7110 MILOD$(228)=CHR$(155)
RS 7120 MILOD$(229)="███E█D█R█I█i█████P█
   ███e███f████E█P/██E█P███e█████████fe
   █e█"
NX 7130 MILOD$(291)="█████████ (e█████feeq
   ██KP█P██i████████e██████████P█P█"
UO 7140 REM POKE 88,ADLO:POKE 89,ADHI
ZM 7160 A=USR(ADR(MILOD$))
JK 7190 CLOSE #1:GOSUB 8000:RETURN
KG 7500 ? "█":POSITION 32,1:? "(319,0)":P
   OSITION 30,22:? "(319,191)":POSITION 1
   ,22:? "(0,191)"
IW 7510 POSITION 1,1:? "(0,0)"
AV 7520 RETURN
RS 8000 BRK=USR(ADR("h██Mhh█████P██████"
   ),BRKX):RETURN :REM DISABLES BREAK WHE
   N ARG=1
```

LISTING 2

```
LJ 10 REM HARD-WIRED RAY TRACING, LISTING
   2
VQ 20 REM BY MICHAEL BJORKMAN
QH 30 REM (c)1988, ANTIC PUBLISHING
UD 35 REM CREATES LINES 2190, 7070-7100,
   7120-7130 & 8000
EV 40 REM (LINES 10-250 MAY BE USED WITH
   OTHER BASIC LOADERS IN THIS ISSUE.
IJ 50 REM CHANGE LINE 70 AS NECESSARY.)
PR 60 DIM FN$(20),TEMP$(20),AR$(93):DPL=P
   EEK(10592):POKE 10592,255
WO 70 FN$="D:LINES.LST":REM THIS IS THE N
   AME OF THE DISK FILE TO BE CREATED
RD 80 ? "█Disk or █assette?";:POKE 764,25
   5
PY 90 IF  NOT (PEEK(764)=18 OR PEEK(764)=
   58) THEN 90
TH 100 IF PEEK(764)=18 THEN FN$="C:"
VB 110 POKE 764,255:GRAPHICS 0:? "      AN
   TIC'S GENERIC BASIC LOADER"
MY 120 ? ,"BY CHARLES JACKSON"
KB 130 POKE 10592,DPL:TRAP 200
PU 140 ? :? :? "Creating ";FN$:? "...plea
   se stand by."
LW 150 RESTORE :READ LN:LM=LN:DIM A$(LN):
   C=1
BQ 160 AR$="":READ AR$
YC 170 FOR X=1 TO LEN(AR$) STEP 3:POKE 75
   2,255
DM 180 LM=LM-1:POSITION 10,10:? "(Countdo
   wn...T-";INT(LM/10);")      "
```

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```
BK 190 A$(C,C)=CHR$(VAL(AR$(X,X+2))):C=C+
   1:NEXT X:GOTO 160
MM 200 IF PEEK(195)=5 THEN ? :? :? "■TOO
   MANY DATA LINES!":? "CANNOT CREATE FIL
   E!":END
CM 210 IF C<LN+1 THEN ? :? "■TOO FEW DATA
    LINES!":? "CANNOT CREATE FILE!":END
UQ 220 IF FN$="C:" THEN ? :? " Prepare ca
   ssette, press [RETURN]"
AR 230 OPEN #1,8,0,FN$
PV 240 POKE 766,1:? #1;A$;:POKE 766,0
AL 250 CLOSE #1:GRAPHICS 0:? "■COMPLETED■
   "
IU 1000 DATA 580
VB 1010 DATA 0500490570480320760790680360
   610341041690071410820031041410850031O4
   1410840031041410890031O4141
AY 1020 DATA 0880031620160320862280960341
   5505504805504803207707307607906803606 1
   034104162016169007157066003
QV 1030 DATA 1692321570680031690001570690
   0316900115707200316900015707300316900 0
   13322403200000061652242O1007
BA 1040 DATA 2400132010132400162010262400
   6023022402414423403415505504805604803 2
   077073076079068036040053053
MV 1050 DATA 0410610341652321332340241442
   4416523214119600223022403200000616523 2
   141197002230224032000006165
CE 1060 DATA 2321411980022302240320000061
   6523214119900223022403200000616523214 1
   200002024144196169000133236
MS 1070 DATA 1330341550550480570480320770
   7307607906803604004904905304106103423 0
   165088133224133228165089133
YQ 1080 DATA 2251332290320000061921362400
   9416900013322716523204112813323516523 2
   041127133226208014032000006
YO 1090 DATA 1652321332270320000061652321
   3322619822616523520802803200000341550 55
   049048048032077073076079068
MB 1100 DATA 0360400490550530410610340061
   6523213323302414404719822616925519722 6
   208245198227169255197227208
MN 1110 DATA 2372401830320000061652321332
   3302414401919822616925519722620823819 8
   227169255197227208230240034
KE 1120 DATA 1550550490500480320770730760
   7906803604005005005704106103409616900 2
   197234240082240201165233160
AM 1130 DATA 0001452240241690801012241332
   2416900010122513322523023016909619723 0
   208047169001197236208024024
WZ 1140 DATA 1690011012281332281332241690
   0013323613323010122913322913303415505 5
   049051048032077073076079068
DO 1150 DATA 0360400500570490410610342250
   2414401723023602416904010122813322416 9
   000133230101229133225165235
QW 1160 DATA 2401762081491652331600001452
   2402416900110122413322416900010122513 3
   225165235240151208229034155
LO 1170 DATA 0560480480480320660820750610
   8508308204006506808204003410416900013 3
   077104104201000240007169112
NQ 1180 DATA 1330161410142100960340410440
   6608207508804105808206908408508207803 2
   058082069077032068073083065
RP 1190 DATA 0660760690830320660820690650
   750320870720690780320650820710610491 55
```

NEW WAY TO SPEED UP YOUR BASIC PROGRAMS

EQUIVALENCE

Article on page 44

LISTING 1

Don't type the TYPO II Codes!

```
PQ 10 REM SOUND EQUIVALENCE
JB 20 REM BY DOUG WHITE
QH 30 REM (c)1988, ANTIC PUBLISHING
AH 40 DIM S$(8)
WL 50 DIM V$(20)
EZ 60 DIM CH$(256)
BE 70 REM
JT 80 VVTST=PEEK(134)+256*PEEK(135)
TH 90 ?
SZ 100 STARP=PEEK(140)+256*PEEK(141)
QO 110 REM
OZ 120 SVNUM=0:REM S$ IS VARIABLE # 0
FU 130 REM IN THE VARIABLE NAME TABLE
QU 140 REM
BG 150 REM CALCULATE OFFSET OF
TP 160 REM FREQ. OF AUDIO CH.#0
RA 170 REM
ZW 180 FREQ=53760
WZ 190 OFFSET=FREQ-STARP
JW 200 AOFFSET2=INT(OFFSET/256)
YM 210 AOFFSET1=OFFSET-256*AOFFSET2
QR 220 REM
SZ 230 VVLOC=VVTST+(SVNUM)*8
EA 240 POKE VVLOC+2,AOFFSET1
FR 250 POKE VVLOC+3,AOFFSET2
QZ 260 REM
KQ 270 REM AFTER THE OFFSET CHANGE
BS 280 REM S$(1,1)=AUDF1  S$(2,2)=AUDC1
KH 290 REM S$(3,3)=AUDF2  S$(4,4)=AUDC2
SD 300 REM S$(5,5)=AUDF3  S$(6,6)=AUDC3
AS 310 REM S$(7,7)=AUDF4  S$(8,8)=AUDC4
QS 320 REM
TZ 330 ? "■":? "       SOUND EQUIVALENCE D
   EMO"
JD 340 ? :? "FILLING CH$ WITH SOUND CONTR
   OL DATA"
DI 350 FOR I=1 TO 255 STEP 2
GN 360 CH$(I,I)=CHR$(255-I)
MT 370 V=V-0.33:IF V<1 THEN V=12
UE 380 CH$(I+1,I+1)=CHR$(160+INT(V))
GL 390 NEXT I
QP 400 REM
WV 410 ? :? :? "CHARACTERS IN CH$ ARE CON
   VERTED INTO"
NS 420 ? "FREQUENCY, DISTORTION, & VOLUME
   "
HM 430 ? "PARAMETERS FOR THE SOUND COMMAN
   D"
YA 440 ? "WITHOUT USING A POINTER STRING.
   "
CR 450 ?
CR 460 FOR LOOP=1 TO 2
JK 470 ? "ITERATION # ";LOOP
FA 480 FOR I=1 TO 248 STEP 2
OK 490 FOR N=0 TO 3
LR 500 F=ASC(CH$(I,I)):X=ASC(CH$(I+1,I+1)
   )
NS 510 D=INT(X/16):V=X-16*INT(X/16)
DV 520 SOUND N,F,D,V
HZ 530 NEXT N
GD 540 NEXT I
NG 550 NEXT LOOP
RC 560 REM
XD 570 ? :? :? "NOW USING A POINTER STRIN
   G"
KR 580 ? :? "CH$ SUBSTRINGS ARE ASSIGNED
   INTO S$."
VY 590 ? "S$ IS STORED IN THE SAME MEMORY
   "
MV 600 ? "LOCATIONS AS THE SOUND CONTROL
   "
FT 610 ? "REGISTERS."
CN 620 ?
IE 630 SOUND 0,0,10,4:SOUND 1,0,10,4
LC 640 SOUND 2,0,10,4:SOUND 3,0,10,4
MW 650 FOR LOOP=1 TO 10
JK 660 ? "ITERATION # ";LOOP
BS 670 FOR I=1 TO 249 STEP 2:S$=CH$(I,I+7
   ):NEXT I
NN 680 NEXT LOOP
ON 690 END
```

LISTING 2

```
HI 10 REM STRING EQUIVALENCE, LISTING 2
JB 20 REM BY DOUG WHITE
QH 30 REM (c)1988, ANTIC PUBLISHING
RV 40 ? "◙":? "        STRING EQUIVALENCE D
   EMO"
OT 50 ? :? "INPUT ARRAY SIZE  ( < 4000 )
   ";
DY 60 INPUT ASIZE
QW 65 IF ASIZE>3999 THEN 50
LE 67 IF ASIZE<10 THEN ASIZE=10
BE 70 REM
QU 80 DIM S$(1),M(ASIZE)
WP 90 DIM V$(20)
US 100 DIM DELAY$(1)
QO 110 REM
QE 120 REM . FIND MEMORY LOCATIONS
GI 130 REM . FOR THE STRING AND THE
TS 140 REM . ARRAY THAT ARE TO BE
CX 150 REM . EQUIVALENCED.
QY 160 REM
XR 170 VNTST=PEEK(130)+256*PEEK(131)
TU 180 VNTEND=PEEK(132)+256*PEEK(133)-1
HJ 190 VVTST=PEEK(134)+256*PEEK(135)
TA 200 STARP=PEEK(140)+256*PEEK(141)
QP 210 REM
AK 220 V$="S$":REM . THE DATA 'STRING'
RA 230 GOSUB 2000
TV 240 SVNUM=VNUM
QX 250 REM
RO 260 V$="M(":REM . THE DATA 'ARRAY'
RI 270 GOSUB 2000
QR 280 AVNUM=VNUM
TH 290 AOFFSETLO=OFFSETLO
FM 300 AOFFSETHI=OFFSETHI
ET 310 ADIM1LO=VDIM1LO:ADIM1HI=VDIM1HI
IB 320 ADIM2LO=VDIM2LO:ADIM2HI=VDIM2HI
QU 330 REM
AM 340 REM . REDIMENSION THE STRING &
LG 350 REM . SET THE STRING OFFSET
IM 360 REM . EQUAL TO THE ARRAY OFFSET
RC 370 REM
NB 380 FIRSTDIM=ADIM1LO+256*ADIM1HI
JF 390 SECONDIM=ADIM2LO+256*ADIM2HI
VP 400 SSIZE=6*FIRSTDIM*SECONDIM
LI 410 HBYTE=INT(SSIZE/256)
OZ 420 LBYTE=SSIZE-256*HBYTE
QV 430 REM
TD 440 VVLOC=VVTST+(SVNUM)*8
FD 450 POKE VVLOC+2,AOFFSETLO
VZ 460 POKE VVLOC+3,AOFFSETHI
OB 470 POKE VVLOC+4,LBYTE
LZ 480 POKE VVLOC+5,HBYTE
PL 490 POKE VVLOC+6,LBYTE
MQ 500 POKE VVLOC+7,HBYTE
QS 510 REM
DV 520 ? :? "FILL M() WITH #'S 1 TO ASIZE
   "
QW 530 REM
NB 540 FOR I=0 TO ASIZE:M(I)=I:NEXT I
RA 550 REM
BH 560 ? :? "WRITE M() TO DISK"
RE 570 REM
LR 580 CLOSE #1
IL 590 OPEN #1,8,0,"D1:ARRAY.DAT"
EE 600 POKE 18,0:POKE 19,0:POKE 20,0
KK 610 FOR I=0 TO ASIZE
PO 620 N=M(I)
GX 630 ? #1;N
PY 635 REM . FOR TURBO BASIC, USE:
AI 640 REM %PUT #1,N
GG 650 NEXT I
DD 660 GOSUB 1500:REM GET TIME
RF 670 REM
DD 680 ? :? "WRITE S$ TO DISK"
RJ 690 REM
LD 700 CLOSE #1
ZJ 710 OPEN #1,8,0,"D1:STRING.DAT"
EJ 720 POKE 18,0:POKE 19,0:POKE 20,0
YC 730 ? #1;S$
PZ 735 REM . FOR TURBO BASIC, USE:
YO 740 REM BPUT #1,ADR(S$),SSIZE
DC 750 GOSUB 1500:REM GET TIME
RE 760 REM
LR 770 CLOSE #1
WE 780 ? :? "PRESS RETURN TO CONTINUE"
HF 790 INPUT DELAY$
QT 800 REM
KE 810 ? :? "FILL M() WITH ONES"
QX 820 REM
EM 830 POKE 18,0:POKE 19,0:POKE 20,0
OG 840 FOR I=0 TO ASIZE:M(I)=1:NEXT I
DD 850 GOSUB 1500:REM GET TIME
GU 860 GOSUB 1600:REM PRINT M(1 TO 5)
RH 870 REM
YQ 880 ? :? "FILL M() WITH 3'S"
VX 890 ? "BY COPYING SUBSTRINGS IN S$"
QU 900 REM
EJ 910 POKE 18,0:POKE 19,0:POKE 20,0
NA 920 M(0)=3:REM M(0) = S$(1,6)
TZ 930 S$(7)=S$(1)
DC 940 GOSUB 1500:REM GET TIME
GT 950 GOSUB 1600:REM PRINT M(1 TO 5)
RG 960 REM
WE 970 ? :? "PRESS RETURN TO CONTINUE"
HF 980 INPUT DELAY$
RM 990 REM
HW 1000 REM
EM 1010 ? :? "REFILL M() WITH DATA BY "
BD 1020 ? "READING 'D1:ARRAY.DAT' INTO M(
   )"
IF 1030 REM
WA 1040 OPEN #1,4,0,"D1:ARRAY.DAT"
AU 1050 POKE 18,0:POKE 19,0:POKE 20,0
HX 1060 FOR I=0 TO ASIZE
UQ 1070 INPUT #1;N
OP 1075 REM . FOR TURBO BASIC, USE:
CI 1080 REM %GET #1,N
RJ 1090 M(I)=N
ER 1100 NEXT I
QQ 1110 GOSUB 1500:REM GET TIME
MR 1120 CLOSE #1
IH 1130 REM
EX 1140 ? :? "REFILL M() WITH DATA BY "
FN 1150 ? "READING 'D1:STRING.DAT' INTO S
   $"
IQ 1160 REM
RH 1170 OPEN #1,4,0,"D1:STRING.DAT"
BF 1180 POKE 18,0:POKE 19,0:POKE 20,0
JK 1190 TRAP 1220:I=0
VC 1200 GOSUB 3000:REM CIO METHOD
NY 1205 REM . FOR TURBO BASIC, USE:
EY 1210 REM BGET #1,ADR(S$),SSIZE
QV 1220 GOSUB 1500:REM GET TIME
IH 1230 GOSUB 1600:REM PRINT M(1 TO 5)
MZ 1240 CLOSE #1
FG 1250 END
BC 1500 REM $  GET TIME
IJ 1510 REM
OR 1520 SEC=(PEEK(20)+256*PEEK(19))/60
SL 1530 ? :? INT(1000*SEC)/1000;
SH 1540 ? " SECONDS"
AY 1550 RETURN
ME 1600 REM $  PRINT M(1 TO 5)
NU 1610 ?
YT 1620 FOR I=1 TO 5
ZO 1630 ? "M(";I;") = ";M(I)
FN 1640 NEXT I
BA 1650 RETURN
KN 2000 REM $  FIND VARIABLE #
IA 2010 REM
OB 2020 J=0:VNUM=-1
SB 2030 FOR I=VNTST TO VNTEND
TU 2040 CH=PEEK(I)
LH 2050 J=J+1
WC 2060 IF CH>128 THEN CH=CH-128:VNUM=VNU
   M+1
SS 2070 IF CHR$(CH)<>V$(J,J) THEN J=0:GOT
   O 2090
RL 2080 IF J=LEN(V$) THEN 2100
FR 2090 NEXT I
HZ 2100 REM
SZ 2110 REM FIND VARIABLE LOCATION
IF 2120 REM
HH 2130 VVLOC=VVTST+(VNUM)*8
AO 2140 OFFSETLO=PEEK(VVLOC+2)
WV 2150 OFFSETHI=PEEK(VVLOC+3)
VZ 2160 VDIM1LO=PEEK(VVLOC+4)
SP 2170 VDIM1HI=PEEK(VVLOC+5)
YN 2180 VDIM2LO=PEEK(VVLOC+6)
VD 2190 VDIM2HI=PEEK(VVLOC+7)
JQ 2200 ? :? "V$ = ";V$;"  VNUM = ";VNUM
AH 2210 RETURN
ZQ 2999 REM CIO METHOD
LG 3000 AD=ADR(S$):ADHI=INT(AD/256):ADLO=
   AD-ADHI*256
AZ 3010 I=848:POKE I+2,7:POKE I+4,ADLO:PO
   KE I+5,ADHI:POKE I+8,255:POKE I+9,255
TF 3030 N=USR(ADR("hhh◙LV◙"),16)
CD 3040 N=PEEK(I+9)*256+PEEK(I+8)
AQ 3050 RETURN
```

FRIENDLY QUIZ THAT KIDS LIKE USING

SPELLING FLASHCARDS

Article on page 22

LISTING 1

Don't type the TYPO II Codes!

```
FJ 10 REM SPELLING FLASH CARDS (VER.5)
PY 20 REM BY ANDY BARTON
QH 30 REM (c)1988, ANTIC PUBLISHING
QK 80 GRAPHICS 18:POSITION 0,3:? #6;"SPEL
   LING FLASH CARDS":? #6:? #6:? #6;"    b
   y andy barton"
LK 90 GOTO 5500
XP 100 REM SUBROUTINES
LM 110 REM COUNTDOWN TIMER
ZI 120 JIFS=SEC*60:THI=(INT(JIFS/256)):TL
   OW=JIFS-THI*256
AJ 130 POKE 66,1:POKE 540,TLOW:POKE 541,T
   HI:POKE 554,1:POKE 66,0
ZF 140 RETURN
XI 150 REM TUNE
RQ 160 FOR Z=1 TO NTS
UW 170 T=(INT(RND(0)*7)+1)*5+40
WB 180 FOR L=14 TO 4 STEP -2
PE 190 SOUND 0,T,10,L
QH 200 NEXT L:NEXT Z
RA 210 SOUND 0,0,0,0:RETURN
GI 220 REM BUZZER
RL 230 FOR Z=1 TO NTS
SR 240 SOUND 0,50,6,10
MQ 250 NEXT Z
RK 260 SOUND 0,0,0,0:RETURN
MQ 270 REM MAIN SUB 1
DD 280 TEMP=TRACK(0,X)*15
XV 290 AW$=AWF$(TEMP,TEMP+15-1)
UL 300 GOSUB 820
EL 310 XAW=9-INT((AWL+1)/2)
QE 320 REM MAIN SUB 1A -- VIEW WORD
UR 330 SEC=VIEW:GOSUB 110
VW 340 POSITION XAW+1,5:? #6;AW$
PW 350 IF PEEK(TFLAG) THEN 350
LF 360 REM BLANK-OUT LETTERS
XH 370 GOSUB 870
UE 380 FOR Z=1 TO AWL:POSITION XAW+Z,6:?
   #6;"_";:NEXT Z
JG 390 ANS$=BLANK$:REM 15 SPACES
ZA 400 RETURN
MY 410 REM MAIN SUB 2
WC 420 REM INPUT LETTERS
BI 430 CHC=1:GOSUB 780
OI 440 POSITION XAW+CHC,5:GET #6,C:IF C<>
   32 THEN CHC=CHC+1:GOTO 540
ZQ 450 POKE CH,255:SEC=LIMIT:GOSUB 110:PO
   SITION XAW+CHC,6:? #6;"■"
UK 460 IF PEEK(CH)<>255 THEN GET #3,CHR:G
   OTO 490
MU 470 IF PEEK(TFLAG)=0 THEN 580
PR 480 GOTO 460
KQ 490 IF CHR=27 OR CHR=155 THEN POKE 712
   ,68:GOSUB 760:TOT=TOT+1:GOSUB 330:GOTO
    430:REM [ESC] OR RETURN
ZU 500 IF CHR=126 THEN 650:REM DELETE
TL 510 IF CHR<>32 AND CHR<>45 AND CHR<>39
    AND CHR<65 OR CHR>90 THEN 440:REM NOT
    " ","-",A-Z
JL 520 POSITION XAW+CHC,6:? #6;"_":POSITI
   ON XAW+CHC,5:? #6;CHR$(CHR)
TF 530 ANS$(CHC,CHC)=CHR$(CHR):CHC=CHC+1
WK 540 IF CHC<=AWL THEN 440
YF 550 REM CHECK SPELLING
FD 560 IF ANS$(1,AWL)=AW$ THEN NTS=WTUNE:
   GOSUB 150:TOT=TOT+1:COR=COR+1:GOSUB 78
   0:ANS$="":GOSUB 870:RETURN
ZD 570 REM MISSPELLED
US 580 POKE 712,68:TOT=TOT+1
LO 590 NTS=BUZZ:GOSUB 220
VZ 600 GOSUB 760
GO 610 FOR Z=1 TO AWL
XT 620 IF AW$(Z,Z)<>ANS$(Z,Z) THEN POSITI
   ON XAW+Z,5:? #6;" "
MQ 630 NEXT Z
OE 640 GOTO 430
QI 650 IF CHC=1 THEN 440
TP 660 POSITION XAW+CHC,6:? #6;"_":CHC=CH
   C-1:POSITION XAW+CHC,5:? #6;" ":ANS$(C
   HC,CHC)=" ":GOTO 440
GE 670 REM TRACK SUB
QU 680 POKE 712,58
RN 690 FOR X=FL TO 1 STEP -1
ZM 700 IF TRACK(1,X) THEN TRACK(1,X)=TRAC
   K(1,X)-1:GOSUB 280:GOSUB 430
LT 710 NEXT X
ZC 720 FOR Z=1 TO FL:IF TRACK(1,Z) THEN 7
   40
ZD 730 NEXT Z:TRACK(1,0)=0
ZL 740 RETURN
BY 750 REM SET TRACK SUB
OG 760 TRACK(1,0)=1:TRACK(1,X)=REPEAT
ZZ 770 REM DISPLAY SCORE
JA 780 POSITION 0,0:? #6;"TOTAL ";TOT:POS
   ITION 0,1:? #6;"RIGHT ";COR
WS 790 Z=CHOICE(CC):POSITION 11,0:? #6;"L
   IST #";Z
DK 795 POSITION 11-2*(DD$(Z*11+9,Z*11+9)<
   >" "),1:? #6;DD$(Z*11,Z*11+10)
ZE 800 RETURN
OJ 810 REM SHORT
VQ 820 AWL=15
TN 830 IF AW$(AWL,AWL)=" " THEN AWL=AWL-1
   :IF AWL>0 THEN 830
ZI 840 IF AWL>0 THEN AW$=AW$(1,AWL)
ZO 850 RETURN
TE 860 REM BLANK-OUT
WU 870 POSITION 0,5:? #6;BLANK$
ZU 880 RETURN
SO 890 REM LOAD FILE
YD 900 FILENAME$="D1:"
JZ 910 Y=4:Z=CHOICE(CC)*11:FOR X=0 TO 7:I
   F DD$(Z+X,Z+X)<>" " THEN FILENAME$(Y,Y
   )=DD$(Z+X,Z+X):Y=Y+1
LX 920 NEXT X
MK 930 FILENAME$(Y)=".":FILENAME$(Y+1)=DD
   $(Z+8,Z+10)
AA 940 TRAP 980:CLOSE #1:OPEN #1,4,0,FILE
   NAME$
RN 950 INPUT #1;FL,VIEW
WL 960 FOR X=1 TO FL:INPUT #1;TEMP$:Y=15*
   X:AWF$(Y,Y+15-1)=TEMP$:NEXT X:AWF$(Y+1
   5)=" "
AS 970 TRAP 40000:CLOSE #1:RETURN
LM 980 NTS=BUZZ:GOSUB 220:? "ERROR -- ";F
   ILENAME$;" is not a":? "Spelling Flash
    Card file"
OK 990 FOR Z=1 TO 350:NEXT Z:POP :GOTO 46
   00
AF 1000 REM SAVE LIST TO DISK
RN 1010 IF FL=0 THEN POSITION 2,21:? BLAN
   K$;BLANK$;"⊞ ABORTED":GOTO 4510
WH 1020 CLOSE #1:OPEN #1,8,0,FILENAME$
PL 1030 ? #1;FL:? #1;VIEW
IL 1040 FOR X=1 TO FL:Y=15*X:? #1;AWF$(Y,
   Y+15-1):NEXT X
RF 1050 GOTO 4510
XK 1060 REM ML SUBROUTINE
PE 1070 POKE 752,1
JL 1080 DL=PEEK(560)+PEEK(561)*256
IB 1090 SC=PEEK(DL+4)+PEEK(DL+5)*256
AB 1100 RETURN
NN 1110 S1=PEEK(SC+704):S2=PEEK(SC+784)
ZC 1120 X=USR(ADLON,SC+400,ADR(STORAGE$),
   160,1700,SC+400,80,SC+560,SC+480,400,A
   DLDAT,DL+15,4)
SY 1130 TC=1:P1=23:IF AWC=1 THEN T2=C*15:
   AW$=AWF$(T2,T2+15-1)
HF 1140 POSITION P1-1-(C>9),10:? C;" ";AW
   $
```

```
LE 1150 P2=SC+443:POKE P2+TC,255*(AWC=1):REM PUT BAR UNDER FIRST LSTTER IN GR.7
AT 1160 RETURN
OK 1170 X=USR(ADLOFF,SC+879,SC+959,400,ADR(STORAGE$),SC+400,160,DL+14,DL+15,4)
UE 1180 POKE SC+704,S1:POKE SC+784,S2
BC 1190 RETURN
WO 3000 REM PROCESS CHOICES
VD 3010 FOR CC=1 TO CHOICE(0)
YR 3020 GOSUB 900
TG 3030 REM RADOMIZE TRACKING ARRAY
PR 3040 FOR X=0 TO FL:TRACK(0,X)=0:TRACK(1,X)=0:NEXT X
JP 3050 FOR TC=1 TO FL
HH 3060 X=INT(RND(0)*FL)+1
ZD 3070 IF TRACK(0,X)=0 THEN TRACK(0,X)=TC:GOTO 3100
KO 3080 X=X+1:IF X>FL THEN X=1
SA 3090 GOTO 3070
OI 3100 NEXT TC
VA 3110 REM LIST WORDS
OE 3120 POKE 752,0
GM 3130 GRAPHICS 2*(FL<11)+1*(FL>10 AND FL<21)+0*(FL>20):POKE 752,1
ZB 3140 IF FL>20 THEN 3160
YH 3150 FOR X=1 TO FL:POSITION 2,X-1:GOSUB 3190:NEXT X:GOTO 3210
RG 3160 HFL=INT((FL+1)/2)
GZ 3170 FOR X=1 TO HFL:POSITION 4,X-1:GOSUB 3190:NEXT X:IF X>FL THEN 3210
II 3180 FOR X=X TO FL:POSITION 20,X-HFL-1:GOSUB 3190:NEXT X:IF X>FL THEN 3210
ML 3190 IF X<10 THEN ? #6;" ";
QU 3200 ? #6;X;" ";:Y=15*X:? #6;AWF$(Y,Y+15-1):RETURN
EV 3210 ? :? " PRESS ANY KEY"
PJ 3220 GET #3,Z
CB 3230 REM MAIN LOOP
EM 3240 GRAPHICS 2+16:POKE 708,214:TC=1:TOT=0:COR=0:GOSUB 780
GZ 3250 POKE 756,CHRSET/256
IN 3260 FOR AWC=1 TO FL
XH 3270 IF TRACK(1,0) THEN GOSUB 680
FC 3280 POKE 712,0:X=AWC
QV 3290 GOSUB 280:GOSUB 430
XE 3300 NEXT AWC
TX 3310 IF TRACK(1,0) THEN GOSUB 680:GOTO 3310
TI 3320 REM REWARD SCREEN
TI 3330 POKE 712,0:? #6;"  ";BLANK$
BJ 3340 POSITION 5,5:? #6;"GOOD WORK":NTS=LTUNE:GOSUB 150
HW 3350 NEXT CC
CC 3360 POKE CH,255:POSITION 2,8:? #6;"ANY KEY TO GO ON":GET #3,CHR:GOTO 4510
MS 3500 REM ADD NEW LISTS
ET 3510 GRAPHICS 2:T2$=BLANK$:Z=0
AJ 3520 POSITION 2,0:? #6;"type in new list"
EO 3530 POSITION 2,3:? #6;"TITLE:":INPUT T1$:IF T1$=" " OR T1$="" THEN ? "█":? :? :? "ABORTED":GOTO 4510
DS 3540 IF T1$(1,1)<"A" OR T1$(1,1)>"Z" THEN ? :? "Must start with a LETTER":FOR X=1 TO 100:NEXT X:GOTO 3510
IX 3545 IF LEN(T1$)>8 THEN ? "█":? :? "Too Long!":FOR X=1 TO 100:NEXT X:GOTO 3510
NE 3550 Y=1:FOR X=1 TO LEN(T1$)
LG 3560 IF Z=0 AND T1$(X,X)="." THEN T2$(Y)=T1$(X,X):Z=Y+3:Y=Y+1
TK 3570 IF T1$(X,X)>="0" AND T1$(X,X)<="9" OR T1$(X,X)>="A" AND T1$(X,X)<="Z" THEN T2$(Y)=T1$(X,X):Y=Y+1
SZ 3580 NEXT X:IF LEN(T2$)>12 THEN T2$=T2$(1,12)
WF 3585 IF Z>0 AND LEN(T2$)>Z THEN T2$=T2$(1,Z)
RH 3586 Z1=LEN(T2$):FOR X=1 TO LEN(T2$):IF T2$(X,X)="." THEN Z1=X-1:Z=0
JC 3587 NEXT X:T2$=T2$(1,Z1)
AO 3590 IF Z=0 THEN T2$(LEN(T2$)+1)=".DAT"
ZU 3595 POSITION 2,5:? #6;T2$:POSITION 2,7:? #6;"ACCEPT? (N)":GET #3,Z:IF Z=78 THEN 3510
DJ 3600 FILENAME$="D1:":FILENAME$(4)=T2$
SS 3610 POSITION 0,7:? #6;"HOW LONG TO PREVIEW?"
BQ 3620 TRAP 3630:VIEW=DVIEW:INPUT Z:VIEW=Z
HI 3630 TRAP 40000:POSITION 2,9:? #6;VIEW;" SECONDS":SEC=VIEW:GOSUB 110
JB 3640 IF PEEK(TFLAG) THEN 3640
TF 3650 GOTO 3820
FP 3660 REM EDIT LIST
JD 3670 TRAP 5000:CHOICE(1)=VAL(CHOICE$(2)):CC=1
OF 3680 GOSUB 900:TRAP 40000
GD 3690 AWC=1:X=0:GRAPHICS 0:GOSUB 1070
LP 3700 ? :? "This file is set to preview words for ";VIEW;" Seconds":? :? "Enter new time or press RETURN"
RZ 3710 TRAP 3740:INPUT Z:VIEW=Z:TRAP 40000
HU 3720 ? :? VIEW;" Seconds":SEC=VIEW:GOSUB 110
IZ 3730 IF PEEK(TFLAG) THEN 3730
YO 3740 ? "█":IF FL>20 THEN 3760
AR 3750 FOR X=1 TO FL:POSITION 2,X-1:GOSUB 3790:NEXT X:GOTO 3830
RS 3760 HFL=INT((FL+1)/2)
TJ 3770 FOR X=1 TO HFL:POSITION 2,X-1:GOSUB 3790:NEXT X
NW 3780 FOR X=X TO FL:POSITION 21,X-HFL-1:GOSUB 3790:NEXT X:GOTO 3830
YK 3790 IF X<10 THEN ? " ";
QH 3800 ? X;" ";:Y=15*X:? AWF$(Y,Y+15-1):RETURN
JO 3810 REM INPUT NEW WORDS
XL 3820 GRAPHICS 0:GOSUB 1070:FL=0
QF 3830 POSITION 2,21:? "Type word or # to Edit          RETURN TO SAVE";
FK 3840 POKE CH,255:GET #3,CHR
JY 3850 IF CHR=155 THEN 1010:REM SAVE FILE
XA 3860 IF CHR<48 OR CHR>57 THEN 3920:REM NOT 0-9
ZY 3870 AWC=1:C=VAL(CHR$(CHR)):SEC=0.5:GOSUB 110
RR 3880 IF PEEK(CH)=255 THEN IF PEEK(TFLAG) THEN 3880
SZ 3890 IF PEEK(CH)<>255 THEN GET #3,Z:IF Z>47 AND Z<58 THEN C=C*10+VAL(CHR$(Z))
UD 3900 IF  NOT (C<1 OR C>FL) THEN 3910
RK 3905 POSITION 4,23:? C;" Is too large";:FOR X=1 TO 99:NEXT X:POSITION 0,23:?BLANK$;:GOTO 3830
UY 3910 GOTO 3950
DO 3920 IF CHR<65 OR CHR>90 THEN 3840:REM NOT A-Z
JC 3930 FL=FL+1:IF FL>40 THEN FL=40:POSITION 2,23:? "MAXIMUN OF 40 WORDS":FOR X=1 TO 150:NEXT X:GOTO 3740
IN 3940 C=FL:T2=C*15:AW$=BLANK$:AW$(1,1)=CHR$(CHR):AWC=0
QX 3950 POSITION 2,21:? BLANK$;BLANK$;:POKE 752,1:POSITION 2,21:? "Type word and press RETURN";
YW 3960 GOSUB 1110
TE 3970 IF AWC=0 THEN TC=TC+1:POKE P2+TC,255
NE 3980 GET #3,CHR
KL 3990 IF CHR=155 THEN 4090:REM RETURN
RX 4000 IF CHR=254 THEN 4190:REM CTRL DELEAT
XV 4010 IF CHR=126 THEN IF TC<>1 THEN 4220:REM DELETE
NL 4020 IF CHR=30 OR CHR=43 THEN 4230:REM "←"
RH 4030 IF CHR=31 OR CHR=42 THEN 4250:REM "→"
JM 4040 IF CHR>64 AND CHR<91 OR CHR=32 OR CHR=45 OR CHR=39 THEN GOTO 4060:REM A-Z OR SPACE OR - OR
WG 4050 GOTO 3980
VV 4060 POSITION P1+TC,10:? CHR$(CHR):AW$(TC,TC)=CHR$(CHR):POKE P2+TC,0
PP 4070 TC=TC+1:IF TC>15 THEN TC=15
FB 4080 POKE P2+TC,255:GOTO 3980
YQ 4090 POKE CH,255:GOSUB 820:POKE 94,PEEK(DL+4):POKE 95,PEEK(DL+5):GOSUB 1170:IF AWL=0 THEN 4160
NQ 4100 T2$(1,15)=BLANK$:T2$(1,AWL)=AW$:AWF$(T2,T2+15-1)=T2$
LS 4120 IF AWC=0 THEN 3740
TX 4130 X=C:IF FL<21 THEN POSITION 2,C-1:
```

continued on next page

```
   GOSUB 3790:GOTO 3830
EL 4140 IF C>INT((FL+1)/2) THEN POSITION
   21,C-HFL-1:GOSUB 3790:GOTO 3830
JY 4150 POSITION 2,C-1:GOSUB 3790:GOTO 38
   30
TW 4160 IF FL<2 THEN POSITION 2,19:? BLAN
   K$;"  ABORTED";:GOTO 4510
II 4170 IF C=FL THEN AWF$=AWF$(1,T2-1):FL
   =FL-1:GOTO 3740
TN 4180 AWF$(T2)=AWF$(T2+15):FL=FL-1:GOTO
    3740
BQ 4190 IF TC=15 THEN AW$(15)=" ":GOTO 42
   10
HR 4200 AW$(TC)=AW$(TC+1):AW$(15)=" "
NT 4210 POSITION P1+1,10:? AW$:GOTO 3980
MU 4220 POKE P2+TC,0:TC=TC-1:POKE P2+TC,2
   55:POSITION P1+TC,10:? " ":AW$(TC,TC)=
   " ":GOTO 3980
RO 4230 IF TC<>1 THEN POKE P2+TC,0:TC=TC-
   1:POKE P2+TC,255
WH 4240 GOTO 3980
LK 4250 IF TC<>15 THEN POKE P2+TC,0:TC=TC
   +1:POKE P2+TC,255
WN 4260 GOTO 3980
DE 4500 REM DISK DIRECTORY & CHOOSE WORD
   LIST(S)
QB 4510 CLOSE #1:OPEN #1,6,0,"D1:*.DAT"
CW 4520 DD$(1)=" ":DD$(65*11)=" ":DD$(2)=
   DD$
RG 4530 DD=1
IR 4540 INPUT #1,TEMP$
WK 4560 IF TEMP$(5,16)="FREE SECTORS" THE
   N 4590
QI 4570 DD$(11*DD,11*DD+10)=TEMP$(3,13):D
   D=DD+1
TO 4580 GOTO 4540
ZB 4590 CLOSE #1:DD=DD-1
EG 4600 GRAPHICS 2*(DD<11)+1*(DD>10 AND D
   D<21)+0*(DD>20):POKE 752,1:? "■":IF DD
   =0 THEN 4740
VM 4610 IF DD>20 THEN X=0:GOTO 4630
KB 4620 FOR X=1 TO DD:POSITION 2,X-1:GOSU
   B 4710:NEXT X:GOTO 4740
HL 4630 IF X=41 THEN 4680
QY 4640 TEMP=DD*(DD<41)+40*(DD>40)
OX 4650 HDD=INT((TEMP+1)/2)
KW 4660 FOR X=1 TO HDD:POSITION 4,X-1:GOS
   UB 4710:NEXT X:IF X>TEMP THEN 4740
JJ 4670 FOR X=X TO TEMP:POSITION 20,X-HDD
   -1:GOSUB 4710:NEXT X:GOTO 4740
DH 4680 HDD=INT((DD-40+1)/2)+40
SD 4690 FOR X=X TO HDD:POSITION 4,X-41:GO
   SUB 4710:NEXT X:IF X>DD THEN 4740
GR 4700 FOR X=X TO DD:POSITION 20,X-HDD-1
   :GOSUB 4710:NEXT X:GOTO 4740
MA 4710 IF X<10 THEN ? #6;" ";
QE 4720 ? #6;X;" ";DD$(X*11,X*11+10);:RET
   URN
XX 4730 REM INPUT MESSAGES
OX 4740 POKE 752,0
PM 4750 POSITION 2,20:? "Choose ■#■ (EX.
   3 or 3,5,9 or 2-7"
GJ 4760 ? "■E■#■ Edit a list    ■N■ New li
   st"
IE 4770 IF DD>40 THEN ? "■RETURN■ more ch
   oices"
QE 4780 ERROR=5000
KY 4790 INPUT CHOICE$
EJ 4800 L=LEN(CHOICE$)
ZY 4810 IF L=0 AND DD>40 THEN GRAPHICS 0:
   POKE 752,1:? "■":GOTO 4630:REM MORE CH
   OICES
CR 4820 IF L=0 THEN 4600
EJ 4830 IF CHOICE$(1,1)="N" THEN 3510
FJ 4840 IF CHOICE$(1,1)="E" THEN 3670
LN 4850 IF CHOICE$(1,1)<"0" OR CHOICE$(1,
   1)>"9" THEN 5000
IB 4860 CC=0:TEMP$=BLANK$:TC=0:DASH=0
UU 4870 FOR Y=1 TO L
UG 4880 IF CHOICE$(Y,Y)<"0" OR CHOICE$(Y,
   Y)>"9" THEN 4910
WH 4890 TC=TC+1
IQ 4900 GOTO 4950:REM NEXT Y
FH 4910 IF TC<>0 THEN CC=CC+1:CHOICE(CC)=
   VAL(CHOICE$(Y-TC)):TC=0:IF CHOICE(CC)>
   DD THEN GOTO 5000
ZZ 4920 IF DASH=1 THEN GOSUB 4990:GOTO 49
   40
LP 4930 IF CHOICE$(Y,Y)="-" THEN DASH=1:G
   OTO 4950
YM 4940 IF CHOICE$(Y,Y)<>"," THEN 5000
MT 4950 NEXT Y
WT 4960 IF TC<>0 THEN CC=CC+1:CHOICE(CC)=
   VAL(CHOICE$(Y-TC)):IF CHOICE(CC)>DD TH
   EN GOTO 5000
GC 4970 IF DASH=1 THEN GOSUB 4990
AL 4980 CHOICE(0)=CC:GOTO 3010
OE 4990 DASH=0:CC=CC-1:X=CHOICE(CC):Z=CHO
   ICE(CC+1)-X:FOR CC=CC TO CC+Z
MD 4995 CHOICE(CC)=X:X=X+1:NEXT CC:CC=CC-
   1:RETURN
BV 5000 NTS=BUZZ:GOSUB 220:? "ERROR -- Wr
   ong Input Form";:SEC=2:GOSUB 110
AW 5010 IF PEEK(TFLAG) THEN 5010
QZ 5020 GOTO 4600
NG 5500 REM EQUATES TABLE
WE 5510 REM VALUE VARIABLES
NX 5520 WTUNE=20:REM LENGTH OF TUNE FOR W
   ORD
FO 5530 LTUNE=80:REM LENGTH OF TUNE FOR F
   INISHING LIST
JS 5540 BUZZ=20:REM LENGTH OF BUZZER FOR
   ERROR
OT 5550 DVIEW=0.75:REM SECONDS TO VIEW WO
   RD (INITIAL DEFAULT VALUE)
TY 5560 LIMIT=20:REM TIME LIMIT (SECONDS)
    TO TYPE EACH LETTER OF THE WORD
HM 5570 REPEAT=3:REM NO. OF TIMES TO REPE
   AT A MISSED WORD
YU 5730 REM INITIALIZE
RY 5740 DIM STORAGE$(160):STORAGE$(1)=" "
   :STORAGE$(160)=" ":STORAGE$(2)=STORAGE
   $:DIM BLANK$(38)
LM 5750 BLANK$=STORAGE$:DIM DD$(65*11):RE
   M DISK DIRECTORY
PJ 5760 DIM FILENAME$(15),CHOICE$(120),TE
   MP$(32),T$(144),T1$(17),T2$(17),CHOICE
   (64)
AH 5770 AWC=0:REM ACTIVE WORD COUNT VARIA
   BLE
GJ 5780 TFLAG=554:REM FLAG FOR COUNTDOWN
   TIMER ROUTINE
CX 5790 DIM AWF$((40*15)+15):REM ACTIVE W
   ORD FILE - A STRING
SK 5800 DIM TRACK(1,40):REM REM TRACKING
   MATRIX - LEVEL (0,X). 0=CORRECT  NOT 0
    = STILL TO DO
UH 5810 REM - LEVEL (1,X) KEEPS TRACK OF
   NO. OF TIMES LEFT TO REPEAT A MISSED W
   ORD
EJ 5820 DIM AW$(15):REM ACTIVE WORD
ED 5830 DIM ANS$(15):REM ANSWER
JJ 5840 CH=764:REM LAST KEY PRESSED
LJ 5850 CLOSE #3:OPEN #3,4,0,"K:"
WV 5860 T$(1,72)="h d/■♥1PrTfTP□fUfPP□fqF
   nPJFO*f●h d/ ▶/ d/ ▶/ d/ +/ d/ ▶/●h d/
   ■♥1PrTFTP□F"
RQ 5870 T$(73,144)="UFPP□FqFnP1FO*h d/ ▶/
    d/ ▶/●h*h(hqqhqPhqUhqThqOhqn+H\H●&n■♥
   1PrTHJPX●/\\\"
FG 5880 TEMP$="h":TEMP$(2,19)=T$(105,122)
   :TEMP$(20,32)=T$(128,140):X=USR(ADR(TE
   MP$),ADR(T$),1536,144)
PZ 5890 ADLON=1567:ADLOFF=1593:ADLDAT=167
   6
AT 5900 CHRSET=(PEEK(106)-8)*256:X=USR(15
   36,57344,CHRSET,512)
LW 5910 RESTORE 5920:FOR Z=504 TO 511:REA
   D X:POKE CHRSET+Z,X:NEXT Z:REM REDEFIN
   E "_"
XS 5920 DATA 0,126,0,0,0,0,0,0
RV 5930 GOTO 4510
```

LISTING 2

```
AM 10 REM SPELLING FLASH CARDS-LISTING 2
PY 20 REM BY ANDY BARTON
FJ 30 REM (c) 1985,1987 ANTIC PUBLISHING
RO 35 REM CREATES LINES 5860-5870
EV 40 REM (LINES 10-250 MAY BE USED WITH
   OTHER BASIC LOADERS IN THIS ISSUE.
IJ 50 REM CHANGE LINE 70 AS NECESSARY.)
PR 60 DIM FN$(20),TEMP$(20),AR$(93):DPL=P
   EEK(10592):POKE 10592,255
WO 70 FN$="D:LINES.LST":REM THIS IS THE N
   AME OF THE DISK FILE TO BE CREATED
RD 80 ? "■Disk or ■assette?";:POKE 764,25
   5
PY 90 IF  NOT (PEEK(764)=18 OR PEEK(764)=
   58) THEN 90
```

```
TH 100 IF PEEK(764)=18 THEN FN$="C:"
VB 110 POKE 764,255:GRAPHICS 0:? "      AN
   TIC'S GENERIC BASIC LOADER"
MY 120 ? ,"BY CHARLES JACKSON"
KB 130 POKE 10592,DPL:TRAP 200
PU 140 ? :? :? "Creating ";FN$:? "...plea
   se stand by."
LW 150 RESTORE :READ LN:LM=LN:DIM A$(LN):
   C=1
BQ 160 AR$="":READ AR$
YC 170 FOR X=1 TO LEN(AR$) STEP 3:POKE 75
   2,255
DM 180 LM=LM-1:POSITION 10,10:? "(Countdo
   wn...T-";INT(LM/10);")     "
BK 190 A$(C,C)=CHR$(VAL(AR$(X,X+2))):C=C+
   1:NEXT X:GOTO 160
MM 200 IF PEEK(195)=5 THEN ? :? :? "TOO
   MANY DATA LINES!":? "CANNOT CREATE FIL
   E!":END
CM 210 IF C<LN+1 THEN ? :? "TOO FEW DATA
    LINES!":? "CANNOT CREATE FILE!":END
UQ 220 IF FN$="C:" THEN ? :? " Prepare ca
   ssette, press [RETURN]"
AR 230 OPEN #1,8,0,FN$
PV 240 POKE 766,1:? #1;A$;:POKE 766,0
AL 250 CLOSE #1:GRAPHICS 0:? " COMPLETED 
   "
HC 1000 DATA 180
YA 1010 DATA 053056054048032084036040049 0
   440550500410610341040321000061600001 77
   2401452122302122080022302 13
NN 1020 DATA 2302402080022302411982382082
   3419823901623009610403210000603212700 6
   032100000603212700603210000 6
HY 1030 DATA 0320040060321000006032127006 0
   9610403210000061600001772401452121982 12
   2080021980341550530560550 48
ZC 1040 DATA 0320840360400550510440490520
   5204106103421319824020800219824119823 8
   2082361982390162320321000 06
DK 1050 DATA 0321270060321000006032127006 0
   9610417010416810413324110413324010413 3
   2131041332121041332391041 33
FL 1060 DATA 2381520721380720961662381600
   0017724014521220020220824809600600701 0
   010034155
```

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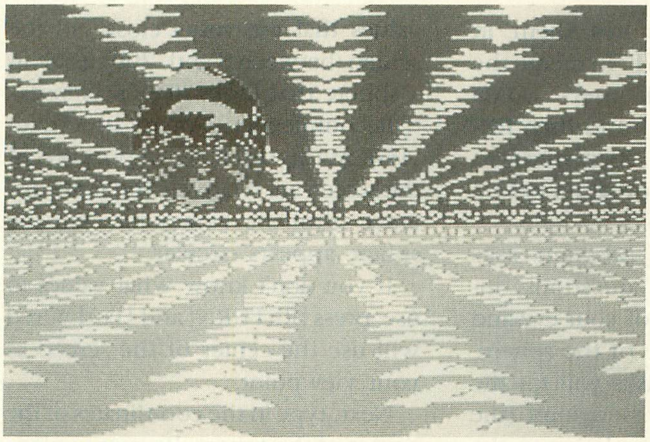


Figure 1, A

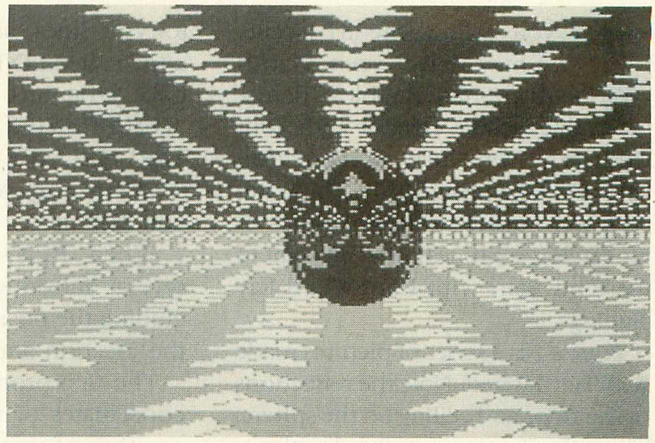


Figure 1, B

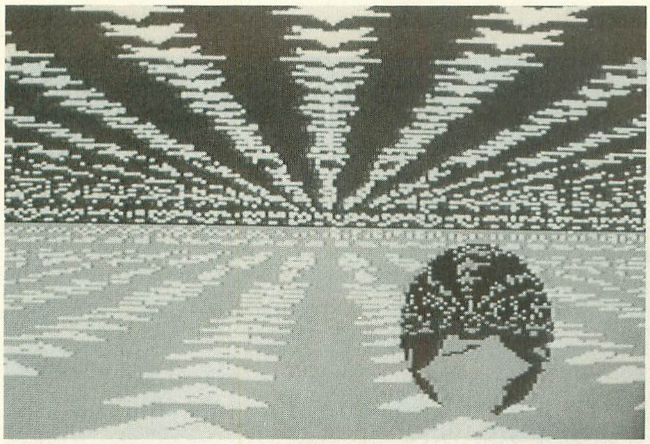


Figure 1, C

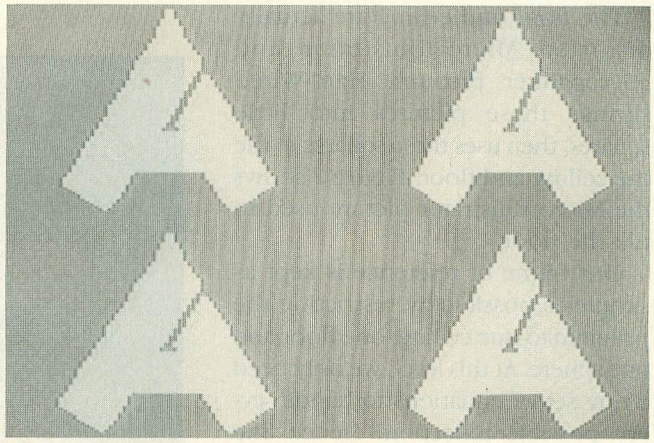


Figure 2

HARD-WIRED *Ray Tracing*

Shadows and reflections for your 8-bit graphics. *By Michael Bjorkman*

Hard-Wired Ray Tracing creates complex pictures with multi-colored patterns, reflections and movable objects, not unlike the famed "Shiny Bubbles" demo on the Atari ST. This BASIC program works on XL and XE computers with at least 64K memory and disk drive.

Type-In Software

If you follow the ST scene, you may have seen Xanth Park's "Shiny Bubbles" demo, or pictures created with Tom Hudson's "Ray-Trace Construction Set" (START, Spring 1987). These images were made using principles of ray tracing, a process now brought to the 8-bit Atari with Hard-Wired Ray Tracing.

Figure 1 is a series of pictures made with Hard-Wired. Note the reflections of the floor and ceiling on the sphere. The reflections were created with ray tracing algorithms.

The floor and ceiling are actually distorted Micro Illustrator and Micropainter pictures. Hard-Wired shrinks these pictures into little squares, then uses these squares to tile the ceiling and floor. *Figure 2* shows the Micro Illustrator picture used to tile the floor.

Our frame of reference is kept as simple as possible by restricting the program to one ceiling, one floor and one sphere. At this level, we only need a tiny set of equations to handle every possible reflection. Hence, the program is called "Hard-Wired" because all of the necessary geometric equations are explicitely defined, or "hard-wired" into the program.

GETTING STARTED

Use your own Micro Illustrator and Micropainter microscreens to create your own ray traced images. You'll need at least two—one for the floor tiles and one for the ceiling tiles. If you want to use pictures created with other paint programs, use the *Rapid Graphics Converter* (**Antic**, November 1985) to convert them to a compatible form.

Next, type in Listing 1, HARDWIRE.BAS, checking it with TYPO II, and SAVE a copy before you RUN it.

If you have trouble typing the special characters in lines 2190, 7070-7130 and 8000, don't type them in. Instead, type Listing 2, check it with TYPO II and SAVE a copy. When you RUN Listing 2, it creates these hard-to-type lines and stores them in a file called LINES.LST. To merge the two programs, disk users LOAD "D:HARDWIRE.BAS" and then ENTER "D:LINES.LST." Remember to SAVE the completed program before you RUN it.

When RUN, the program asks several introductory questions, including the position of your eye and the location and size of the sphere.

The first prompt asks you for the coordinates of your viewpoint (the position of your eye relative to the screen.) Under this coordinate system, (0,0) represents the top-left corner of your screen, (319,0) represents the top-right corner, and (319,191) is the bottom-right corner.

The Z-axis runs "through" your monitor. Objects "inside" your monitor have positive Z values; those in front of your monitor have negative values. For example, the coordinates (319,191,-100) name a point 100 units in front of the bottom-right corner of the screen and the point (0,0,0) is on the surface of the screen at the top-left corner.

Type in the coordinates of your viewpoint.

Remember that your viewpoint is always "outside" the monitor, so your Z-coordinate must be negative. Z-values that are very "close" to the screen (between 0 and -200) result in a sphere that looks like an ellipse.

Recommended Z-values are around -450. At this distance, all portions of the screen are relatively the same distance from the viewpoint, and the sphere appears circular.

If you don't know what values to use, press [RETURN] and Hard-Wired will use the center of the screen as your viewpoint.

Next, type in the coordinates of the center of the sphere. Be sure to place the sphere below the ceiling, above the floor, and not too far left or right. Otherwise, it will not be on the screen. Values near the center of the screen work best.

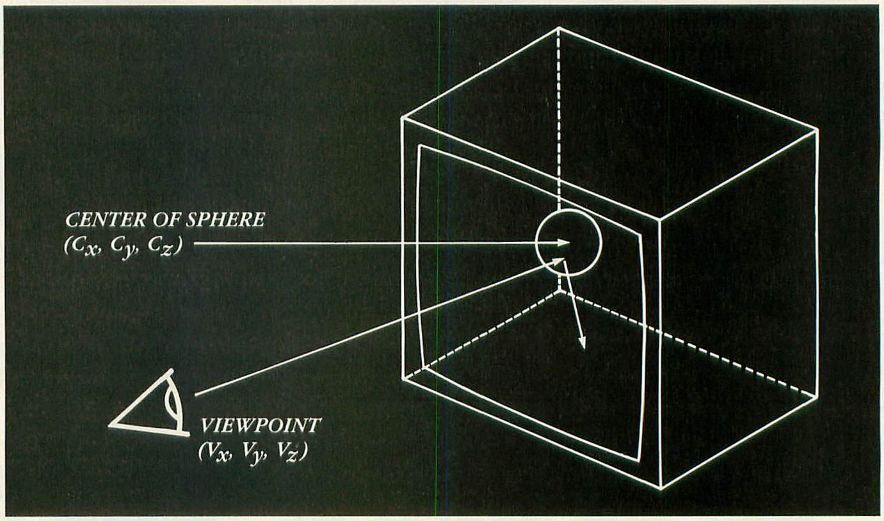


Figure 3

Again, if you don't know what values to use, just press [RETURN] and Hard-wired will place the sphere in the upper-left part of the screen.

Now, type the radius of the sphere. This number must be small enough for the sphere to fit entirely between the ceiling and the floor. Otherwise, the program will print COORD ERROR on the screen and re-prompt for the radius. If you can't think of a value, press [RETURN] and Hard-Wired will calculate a legal one for you.

The next two questions let you

move the pictures within the floor and ceiling tiles. If you're creating a series of screens for a "Shiny Bubbles"-style animation, you can use this feature to scroll the floor and ceiling back and forth or side to side. The floor and ceiling move as one; they cannot be moved independently.

If you type 160,0, the image will be moved left, with what would have been the middle of the floor tile moved to the left side of the tile. Typing 0,-95.5 will set the bottom of the screen half a floor tile deeper "into" the image.

Next, Hard-Wired asks if you want to use its Dimming feature. Type Y to use this feature, or N (or [RETURN]) to shut it off.

Finally, Hard-Wired asks you for the microscreens you want to use for the floor and ceiling tiles. You can use Micro-Painter or Micro Illustrator screens. You do not have to type the "D:" prefix when typing their filenames. Once Hard-Wired loads both screens, the screen will go dark and it will begin plotting the ray-traced image.

When it's done, Hard-Wired saves the image to a Micropainter-compatible file called TRACE.PIC. If you want to use a different filename, type it into line 1380.

DIMMING

When light reflects from an object in the real world, part of the light is absorbed and part of it is reflected. This makes the reflected image appear somewhat dimmer.

When you use the Dimming feature, Hard-Wired will dim the rays reflecting off of the sphere. This limits the number of colors you can use in your original microscreens because each each color will require *two* color registers—one register for the dimmed color and one for the pure color.

Hard-Wired dims the rays by decrementing the color register number. For example, a ray hitting the floor on a pixel with the color in register 3 is reflected from the sphere as the color in register 2. A color in register 0 is reflected as color register 0.

Since Hard-Wired uses GRAPHICS 15, a four-color mode, you may only want to use two of the available colors when drawing your microscreens. Alternatively, you may want to draw your original microscreens with several shades of a single color, such as white, light gray, dark gray and black. If you wish to change the colors that Hard-Wired uses, just alter the SETCOLOR statements in lines 2040-2070.

RAY TRACING 101

Ray-traced images are made by reversing the path that a ray of light takes to your eye. A diagram of one path that a ray may take is shown in *Figure 3*. This ray's path begins at your eye (the viewpoint), passes *through* the screen and *into* the room containing the sphere.

Once in the room the ray might hit the ceiling, the floor, or the sphere. If the ray hits the sphere, it is reflected onto the floor or the ceiling. In any case, every ray that enters the room eventually lands somewhere on the floor or ceiling.

When the ray lands, the program notes the color of its "point of contact." This color is "mapped" onto the screen at the point where the ray passed through it. If we trace a ray for every point on the screen, eventually we'll have a complete picture.

ANIMATIONS

Once you feel comfortable with Hard-Wired, you can build animations, featuring scrolling floors and moving spheres.

Hard-Wired will *not* animate your microscreens; you must use a separate animation or page-flipping program instead. MovieMaker will do the job, however you'll have to use **Antic's** *Rapid Graphics Converter* to convert your hard-Wired pictures from Micro-Painter to MovieMaker format. Since MovieMaker pictures have half the resolution of Micro-Painter pictures, your microscreens will appear coarser. However, you'll be able to fit twice as many screens into an animation.

There are also many public domain page-flipping programs. They're also simple to write. See Dave Plotkin's *Page Flipping, A Racy Tutorial* (**Antic**, January 1984) and Ian Chadwick's *130XE Memory Management* (**Antic**, November 1985) for more information on page-flipping.

Hard-Wired's screen is turned off to hasten the computations by 15 to 30 percent. Press [OPTION] to see the picture as it is being drawn. Using Atari BASIC, each image takes about two hours to calculate. You can achieve much faster speeds with BASIC XE's "FAST" mode or TurboBASIC.

PROGRAM TAKE-APART

Lines 1000 to 1640 contain the "hard-wired" ray-tracing equations needed to map the pixels onto the sphere, floor and ceiling.

Lines 1650 to 1780 use INPUT statements to get the coordinates of the viewpoint and the sphere, the sphere's radius, and the displacement of the floor and ceiling tiles.

Lines 1880 to 2010 load the two microscreens into RAM. One 8K block of memory is set aside for each screen, and a third block is used to plot the final ray-traced image. All in all, Hard-Wired is manipulating three complete microscreens and three separate display lists.

Hard-Wired finds the spot where the ray hits the floor or ceiling, then uses the LOCATE command to determine the color of the pixel it hit. Hard-Wired then finds the spot where the ray passed through the screen and colors it with this color. ▲

Michael Bjorkman of Seattle, Washington is making his first appearance in **Antic**.

Listing on page 30

Type-In Software

EQUIVALENCE

New way to speed up your BASIC programs.

By Doug White

Equivalence teaches intermediate-level programmers how to use a powerful technique that speeds up common BASIC operations by as much as 150 percent. Included BASIC demonstration programs

Atari BASIC is a very friendly programming language, but certain operations can be rather slow. Disk I/O, integer calculations, FOR-NEXT loops, etc. all involve floating-point calculations requiring six storage bytes for each variable used. These operations are slow because they require many integer-to-floating-point and floating-point-to-integer conversions.

String operations, on the other hand, are quite speedy. "Equivalencing" lets you apply these speedy operations to other types of data. Equivalencing can make numeric disk I/O and other operations run up to 150 times faster.

FIGURE 1			(RAMdisk)
ATARI BASIC		D1:	D8:
INITIALIZE M(3334)		39.50	39.50
INITIALIZE S$(20004)		0.33	0.33
M(3334) →	Dn:ARRAY.DAT	99.03	53.58
S$(20004) →	Dn:STRING.DAT	83.95	5.73
Dn:ARRAY.DAT →	M(3334)	91.95	64.65
Dn:STRING.DAT →	S$(20004)	19.48	0.44

EQUIVALENCING

Equivalencing simultaneously treats blocks of data as string data *and* as floating-point data.

Your Atari stores strings and numbers as bytes in RAM. BASIC uses a series of tables to remember which of these bytes are part of strings and which bytes represent floating-point numbers. By changing these tables you can take a series of bytes that represent a floating-point number and make BASIC treat these bytes as a string *as well as* a number.

These tables also contain the locations of all the variables in your program. They work like an address book. Once BASIC determines whether a series of bytes contain a string or a floating-point number, it goes back to these tables to find the location of these bytes.

Change these tables and you change the memory locations that BASIC will search for the values of your variables. It's like telling your mother-in-law that you moved to Borneo. The next letter she sends you will end up in Indonesia.

By altering the values in these tables, you can take any block of memory and treat it like a string.

Equivalencing techniques let you take advantage of BASIC's speedy string operations while avoiding time-consuming floating-point conversions.

SPEED DEMOS

Listing 1 uses sound to illustrate this dramatic improvement in speed. Type in Listing 1, EQUIV1.BAS, check it with TYPO II and SAVE a copy to disk. Be sure to remove the TYPO II program, as described in the TYPO II instructions, *before* you RUN the program.

The first part of the program plays all four voices using BASIC's SOUND command.

This part of the program can be slightly accelerated by POKEing the sound data directly into the audio control registers (memory locations 53760-53768).

The second part of the program uses an equivalenced string to fill all audio control registers at once. First, the program DIMensions a string called S$. Then it alters the variable tables, fooling BASIC into thinking that S$ has moved to a different address (the audio control registers).

The next time BASIC looks for the bytes in S$, it'll end up at the audio control registers. Since BASIC thinks that S$ is located at the audio control registers, anything we put into S$ will appear in these registers.

Here's an example. If we tell BASIC that S$ begins at memory location 53760 (the address of the first audio control register) then:

S$(1)="A"
ASC("A")=65

has the same effect as (but *much* quicker than):

POKE 53760,65

We've just equivalenced a string variable to a specified block of memory—the audio control registers. Listing 2 shows you how to equivalence a string to a numeric array to speed up data handling.

DATA HANDLING

Listing 2 creates a sample floating-point array, M(), writes it to disk and reads it back again. The first time the program does this, it uses GET, PUT and other conventional methods of handling data. Then, the program does the same thing all over again, but this time it uses speedy equivalencing techniques.

The entries in *Figure 1* are the run times in seconds for each part of Listing 2 when M() has 3,334 elements.

Type in Listing 2, EQUIV2.BAS, check it with TYPO II and SAVE a copy to disk. Be sure to remove the TYPO II program, as described in the TYPO II instructions, *before* you RUN the program.

work on all 8-bit Atari computers of any memory size, with disk drive. The article also explains how to use the Turbo BASIC XL language for even greater speed.

FIGURE 2

Turbo BASIC XL		D1:	D8: (RAMdisk)
INITIALIZE M(3334)		9.55	9.55
INITIALIZE S$(20004)		0.27	0.27
M(3334)	→ Dn:ARRAY.DAT	84.72	22.18
S$(20004)	→ Dn:STRING.DAT	52.97	0.40
Dn:ARRAY.DAT	→ M(3334)	50.70	21.88
Dn:STRING.DAT	→ S$(20004)	19.32	0.42

When RUN, the program asks you to choose the size of the sample floating-point array. As written, the program cannot handle such arrays DIMensioned above 4,000.

Next, the program equivalences array M() to a string, S$, and begins filling M() with numbers. Since M() and S$ are equivalenced, every value placed in M() also appears in S$, but in a slightly different form.

Since BASIC stores numbers as six-byte binary coded decimals (BCD), your equivalenced string requires 6 characters for each floating-point number. For example, the number 41.4243444 is internally represented as @ABCDE.

So if you wanted to equivalence an array containing 3,334 numbers, you'd need a string DIMensioned to (6×3,334) or 20,004.

TIMING

The program also times itself. The first column of entries in *Figure 1* is

for my own disk drive—a single density Indus GT. The times you get may be different if you use a different brand of disk drive. The second column in *Figure 1* contains run times for a RAMdisk.

The first entry in *Figure 1* is the number of seconds it takes to write 3,334 elements (20,004 bytes) from M() to a disk file named D1:ARRAY.DAT. If the same data gets written as a 20,004-byte string to a disk file named D1:STRING.DAT, the run time decreases from 99.03 seconds to 83.95 seconds. If you write the data to RAMdisk files, writing to the string is almost ten times faster than writing to the floating-point array, 53.58 seconds and 5.73 seconds, respectively.

The increase in the speed of initializing the arrays is even more impressive. Ordinarily you'd initialize a floating-point array with a FOR-NEXT loop, such as in line 540 of Listing 2.

You can do the same thing with an equivalenced string in two quick steps. Assign the first element the regular way, M(0)=-1. Since S$ is equivalenced to M( ), this assignment will also change the first six bytes of S$.

Now you can copy the first six bytes throughout the rest of the string with the statement:

```
S$(7)=S$(1)
```

This statement will change every value in M( ) to -1. The equivalenced string method is 120 times faster than the FOR-NEXT loop for an array of 3,334 elements.

The bad news is that BASIC lacks a speedy way to read D1:STRING.DAT back into S$. So we resort to a little machine language.

The subroutine beginning at line 3000 in Listing 2 uses your Atari's built-in CIO (Central Input/Output) routines to read a disk file into a string at machine language speed.

In this routine, AD is address of the string. It is broken into low- and high-bytes in line 3000. The expression POKE I+8,255:POKE I+9,255 tells CIO to read as many bytes as it can, up to 65,535 bytes, or until it reaches the end of the file. Line 3030 contains the USR function which starts the CIO routines. When CIO is through, line 3040 calculates the number of bytes which have been read and stores it in N.

To learn more about CIO, read the CIOV section (location 58454) of Ian Chadwick's "Mapping The Atari" ($16.95, Compute! Publications).

Equivalencing avoids time-consuming floating-point conversions.

TURBO BASIC XL

If you own an XL or XE, Turbo BASIC XL also has the fast I/O commands you need.

Turbo BASIC XL is by Frank Oztrowski, of West Germany, author of Michtron's GFA BASIC for the Atari ST. Turbo is a public domain BASIC interpreter and compiler that offers a more powerful programming environment. It's available on CompuServe's 8-bit Atari Forum and from many Atari users groups.

Turbo BASIC supports structured programming, provides new I/O, editing, and DOS functions, and RUNS several times faster than Atari BASIC. Unfortunately, it does *not* work on Atari 400 or 800 computers.

Turbo BASIC XL has %GET and %PUT commands to read and write numeric data to and from disk, and BGET and BPUT to read and write string data to and from disk. Substituting these commands for the Atari BASIC commands in Listing 2 will give you the run times listed in *Figure 2.* The Turbo BASIC commands and their Atari BASIC equivalents are in lines 630-640, 730-740, 1070-1080 and 1200-1210.

Turbo BASIC is somewhat faster than Atari BASIC for the floating-point routines. Reading into S$ from RAMdisk or writing S$ to RAMdisk takes only four tenths of a second in Turbo BASIC! If the string is a little smaller, such as 8,138 bytes (the size of a GRAPHICS 8 screen & display list) the read and write times are less than two tenths of a second. Reading or writing a GRAPHICS 0 screen (992 bytes) to or from RAMdisk takes one tenth of a second.

The net effect is that programs using Turbo BASIC, RAMdisks and equivalencing will transfer data 130 to 150 times faster than programs which don't use these techniques. If you add the extra time that a physical disk drive takes, the increase in speed is two to five times, still a significant increase.

HOW IT WORKS

Let's take a closer look at the way BASIC handles variables. In Atari BASIC (and all compatible BASICs) variables are stored in tables. The three tables of interest here are the variable name table, the variable value table, and the string and array table.

VARIABLE NAME TABLE

The variable name table is merely a list of all of the names of the variables used in your program. Instead of putting a space between the variable names (and wasting a byte), the last character in each name is stored as an inverse character. If our program contains the variables— TOTAL, AR-

RAY(5), and NAME$(10)—the variable name table would look like this:

```
TOTALARRAY(NAME$
```

Atari BASIC recognizes three classes of variables—scalars, floating-point arrays and strings. If the last character in the variable name is an inverse letter or number, as in TOTAL, the variable is a simple floating-point number called a scalar.

If the last character is an inverse open parenthesis, as in ARRAY, the variable is a floating-point array. And if the last character is an inverse dollar sign, as in NAME$, it is a string variable.

The address of the beginning of the variable name table is stored in memory locations 130 (low byte) and 131 (high byte). Calculate the starting address of this table with the equation:

PEEK(130) + PEEK(131) * 256

Floating-point calculations are slow compared to string operations.

The ending address of the variable name table is one less than the number stored in memory locations 132 and 133.

VARIABLE VALUE TABLE

The variable value table contains type and size information about each variable. The starting address of the variable value table is kept in memory locations 134 and 135.

Each variable in the variable name table has a corresponding eight-byte block of information in the variable value table. These blocks are kept in the same order as the names in the variable name table.

The first byte in each block represents the variable type. A 0 represents a scalar, 64 and 65 denote floating-point arrays, and a 128 or a 129 represent a string variable.

The second byte of each block is the variable number (0—127) as assigned by BASIC.

If the variable is a scalar, the remaining six bytes contain its binary coded decimal (BCD) value, as described above.

If the variable is a floating-point array or a string, the third and fourth bytes contain the location of the array (or string). This location is *not a memory address*, but its offset into a table containing all the strings and arrays used in your program. This table, called the string and array table, is discussed later in this article.

If the variable is a floating-point array, the fifth and sixth bytes are equal to one plus the first DIMension size, and bytes seven and eight are equal to one plus the second DIMension size.

For example, the statement DIM ARRAY(7,13) would set bytes five and six equal to 7+1, or 8, and bytes seven and eight would equal 13+1, or 14. (If ARRAY was a one-dimensional array, bytes 7 and 8 would equal 0+1, or 1.)

If the variable is a string, the fifth and sixth bytes contain the current length of the string. The seventh and eighth bytes contain the DIMensioned size of the string.

For example, when BASIC processes the statement DIM NAME$(10), it sets bytes five and six to zero because the LENgth of NAME$ is zero. (Bytes five and six remain at zero until your program puts something into NAME$.)

Bytes seven and eight would equal ten, the DIMensioned size of the string.

STRING & ARRAY TABLE

The string and array table contains the contents of all the strings and arrays used in your program. The starting address of this table is kept in memory locations 140 and 141.

Each time your program introduces a new string or array, its contents are appended to the string and array table. BASIC keeps track of these variables by noting their offset from the beginning of the string and array table, and storing this number in the variable value table.

In other words, the first array is located at the beginning of the string and array table and has an offset of zero. The second array's offset would be equal to the size of the first array.

HOW TO EQUIVALENCE

These variable tables let BASIC give each variable a unique set of data that points to a unique area of RAM. When you *equivalence* two variables, you manipulate these tables so that the two variables share the same area of RAM. Scalars, arrays, and strings may be equivalenced in any combination, as long as the equivalenced memory locations do not overlap other variables.

Once you understand how the variable tables work, equivalencing is merely a matter of altering the eight-byte blocks in the variable value table. Just copy the array's offset and dimension information into the offset and dimension information of the string. Here's an example:

```
NEW
DIM A$(1),B(2)
```

After BASIC processes these statements, the variable name table will look like this:

```
A$B(
```

And the variable value table will look like this:



Which is equivalent to:

129 0 0 0 0 0 1 0
(entry for A$)

65 1 1 0 3 0 1 0
(entry for B())

Let's interpret each eight-byte block. In the first block, the first byte, a 129, tells us that the variable is a string. The second byte, a 0, means that it is variable number 0—the first variable in your program. It also means it's the first entry in the variable name table, A$.

Bytes three and four, also zeros, mean that its offset from the beginning of the string and array table is zero.

Since no elements have been entered, A$ has a LENgth of 0 (bytes 5 and 6 = 0), but has been DIMensioned to 1 (byte 7 = 1 and byte 8 = 0).

The second block contains information about the second variable. Here, the first byte, a 65, tells us that the variable is a numeric array. The second byte, a 1, means that it is variable number 1—the second variable in your program. It also means it's the second entry in the variable name table, B().

Bytes three and four, a one and a zero, mean that the B() offset from the beginning of the string and array table is one—the maximum size of the previous variable A$.

Bytes five through eight contain the variable's DIMensioned size. BASIC arrays may have up to two indexes, and both sizes are stored here. Bytes five and six show the DIMensioned size of the first index + 1. Bytes seven and eight show the DIMensioned size of the second index + 1.

In this example, the DIMensioned size of the first index is 2. Byte five contains (2+1), or 3, and byte six contains zero.

Since there is no second index, its value is 0. Byte seven contains (0+1), or 1, and byte eight contains zero.

To equivalence A$ and B(), copy bytes three through eight of block two into bytes three through eight of block one. The variable value table will now look like this:

129 0 1 0 18 0 18 0
(entry for A$)

65 1 1 0 3 0 1 0
(entry for B())

Block two has not changed, but block one now points to the same memory locations as block two. Both now have the same offset into the string and array table.

The increase in the speed of initializing arrays is impressive.

You'll notice that bytes five through eight were not copied as you'd have expected. These bytes, describing the DIMensioned size of the array, appears to have jumped from 3 to 18!

Nothing's *really* changed, though. As an array, B() may hold up to three floating point numbers. Since your Atari needs six bytes to store a single floating point number, it needs 18 bytes to store three of them. Thus, if A$ and B() are to use the same piece of RAM, A$ must be 18 bytes long.

Since A$ and B() now occupy the same 18 memory locations, any change in A$ will affect B() and vice versa.

Substring		Array Element
A$(1, 6)	⟷	B(0)
A$(7,12)	⟷	B(1)
A$(13,18)	⟷	B(2)

A$ was originally DIMensioned for one element for the sake of simplicity. If A$ had a DIMension of 600, its new offset would be 600 after equivalencing.

Bytes 0 to 599 of the string and array table would be inaccessible memory.

	Inaccessible Memory	A$ and B() stored here
Bytes	0 to 599	600 to 617

If you don't like wasting this much memory, you can alter the variable value table so that the offset and DIMensions of both A$ and B() include all 618 bytes.

A$ would then have a DIMension of 600 + 3 * 6, or 618. B() would have a DIMension of 600/6 + 3, or 103. Wasting memory will usually not affect your program. However, you should be aware of some potential problems with equivalenced variables.

POTENTIAL PROBLEMS

Losing your place. This happens when you incorrectly equivalence your variables. This can happen when creating the equivalence, or whenever the program processes a misplaced CLR statement.

A CLR statement zeroes all of the variables and sets the offsets, string lengths, and array dimensions to zero in the variable value table. The equivalence between variables is destroyed.

When you re-dimension the strings and arrays, BASIC once more assigns a unique offset for each. Each variable will control its own part of memory again.

Finally, remember that the order of your variables in the variable tables is subject to change whenever you LIST your program to disk. The SAVE/LOAD commands preserve your program's original variable name table. The LIST/ENTER commands do not. When a LISTed program is ENTERed, BASIC builds a new variable

continued on page 56

Error Trapping in Atari BASIC

Crashes that you can prevent. *By Heidi Brumbaugh,* START Programs Editor

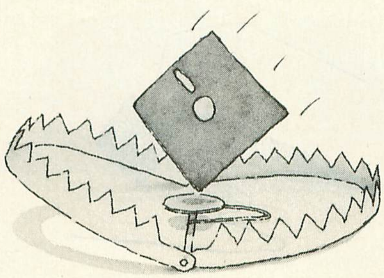
Of the hundreds of program submissions Antic receives each year, many which are otherwise excellent must be rejected because they lack error trapping. No matter how thoroughly you test your program, errors can still crash it during operation simply because the user isn't as familiar with it as you are. This article will show you some error-trapping routines designed to make everybody's life easier.

Before sending your program out into the world, ask yourself, "Will something as simple as a user's misinterpretation of a prompt make the listing crash?

You've already done the hard part—making your program understandable to the machine. Now you just need to fine-tune it for sensitivity to any off-the-wall keystroke combinations the user tries.

SET A TRAP

To make sure our program—not the operating system—takes control when an error occurs, we must first tell the computer, "If there's an error, let the program handle it." Predictably, this is called error trapping. The BASIC syntax we need to use is: TRAP linenum.



Here linenum is the program line for the computer to go to if an error occurs. At linenum we analyze the situation and act accordingly. Put this statement at the beginning of your program to enable error trapping before any problems crop up.

The trap must be reset each time an error occurs. Otherwise the operating system resumes control the next time there's an error. A good place to reset the trap is at the first line of your error-handling routine—but make sure it doesn't have any bugs. If you always put a TRAP statement there, you won't have to worry about the operating system taking over when you don't want it to.

You don't *need* to have an error to declare a new TRAP statement. When the computer encounters a TRAP statement, it remembers only the new line number and goes there if an error occurs. Thus we can have one central location for handling errors. Or we can reset the trap and go to different error-handling routines depending on where the error occurs. We'll use the second method in these examples, but you'll learn how to do it either way.

Of course, you won't always be able to deal effectively with an error. Unforeseen circumstances do tend to arise. The BASIC equivalent to throwing your hands up and telling the operating system, "I don't know what to do—*you* handle it" is to set a TRAP statement to an illegal line number. (BASIC allows line numbers between 0 and 32767.) Most programmers use 40000. This shuts off any previous TRAP statements.

Let's experiment, using the example of a user trying to write to a write-protected disk. We can handle this easily by asking the user to remove the write-protect tab and try again.

```
100 TRAP 30000
```

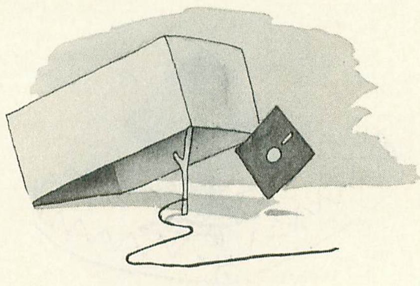
illustrations by: Dwight Been

```
110 OPEN #1,8,0,"D:DUCKS.DAT"
120 ? #1,"Donald"
130 ? #1,"The, Howard"
140 ? #1,"Daffy"
145 ? #1,"Sitting"
150 CLOSE #1
160 ? "Names entered."
170 END
30000 TRAP 30000:REM Reset trap
30010 CLOSE #1:REM Close channel
30020 ? :? "Disk is write-protected.":?
30030 ? "Please remove write-protect tab and"
30040 ? "put disk back in drive.":?
30050 ? "Press any key to continue.":POKE 764,255
30060 IF PEEK(764)=255 THEN 30060:REM Wait for keypress
30070 POKE 764,255:REM Clear last key pressed
30080 GOTO 110:REM Try again
```

This program works fine if it encounters the error we've anticipated. However, the key to error trapping is to consider every *possible* error. Here, the disk drive may be empty or disconnected, or the disk may be full or even have a bad sector.

The computer stores the number of the last error encountered in memory location 195. We can use this information to modify our error-trapping routine.

```
100 TRAP 30000
110 OPEN #1,8,0,"D:DUCKS.DAT"
120 ? #1,"Donald"
130 ? #1,"The, Howard"
140 ? #1,"Daffy"
145 ? #1,"Sitting"
150 CLOSE #1
160 ? "Names entered."
170 END
30000 TRAP 30000:REM Reset trap
30010 CLOSE #1:? :REM Close channel
30015 ERR=PEEK(195)
30020 IF ERR=144 THEN 30150:REM Disk is write-protected
30030 IF ERR=138 THEN 30200:REM Device does not respond
30040 IF ERR=139 OR ERR=164 THEN 30250:REM Having odd problems
30050 IF ERR=140 OR ERR=142 OR ERR=143 THEN 30300:REM Disk may be damaged
30060 IF ERR=162 THEN 30350:REM Disk full
30070 IF ERR=167 THEN 30400:REM File locked
30080 IF ERR=169 THEN 30450:REM Directory full
30090 ? "Error number ";ERR;" has occurred.":GOTO 30500:REM Don't know what's happened
30150 ? "Disk is write-protected.":?
30160 ? "Please remove write-protect tab and"
30170 ? "put disk back in drive."
30180 GOTO 30500
30200 ? "Device is not responding."
30210 ? "Check disk drive cables and try again."
```



```
30220 GOTO 30500
30250 ? "I'm having trouble opening file."
30260 ? "I suggest you check disk drive"
30270 ? "and try again."
30280 GOTO 30500
30300 ? "Your diskette may be damaged."
30310 ? "I suggest you try again or use"
30320 ? "another disk."
30330 GOTO 30500
30350 ? "Disk is full."
30360 ? "Please insert a new disk & try again."
30370 GOTO 30500
30400 ? "You already have a DUCKS.DAT file"
30410 ? "and it is locked. Insert new disk"
30420 ? "and try again or abort operation."
30430 GOTO 30500
30450 ? "You can only have 64 files on a disk."
30460 ? "Please insert new disk and try again"
30470 ? "or abort operation."
30500 ? :? "Press R to retry; A to abort."
30510 OPEN #1,4,0,"K:":REM Open keyboard for input
30515 GET #1,OPT:CLOSE #1:REM Get option and close channel
30520 IF OPT=65 OR OPT=97 THEN 170:REM Abort
30530 IF OPT=82 OR OPT=114 THEN 110:REM Try again
30540 GOTO 30500:REM Wait for A or R
```

Granted, you normally wouldn't want such a complicated error-handling routine for so simple a program. But it's a good example of how error trapping can make a program easy for anyone to run. We could even make the routine *more* complicated by having the program offer to unlock a locked file or delete some files if the disk or directory is full. The main thing is to be familiar with these techniques.

PREVENTIVE MAINTENANCE

You can also use preventive programming techniques to make sure that some errors never occur. Consider this short program to divide two numbers:

```
100 ? "Numerator"; INPUT N
110 ? "Denominator"; INPUT D
120 ? "The answer is:"; N/D
130 GOTO 100
```

This program will crash if the user enters zero as a denominator. While we could add a TRAP statement and a complicated error-handling routine, it's much simpler to check the input before the division ever occurs:

```
115 IF D=0 THEN PRINT "Division by zero is a no-no.":GOTO 110
```

Another problem happens when

the user tries to put too many numbers into an array. Rather than check for an array dimension error we can avoid a problem by counting the numbers as they are entered.

100 TRAP 40000:REM Let the operating system handle any errors

110 DIM NUMS(100):I=0

120 IF I=100 THEN ? "I can't accept any more numbers.":GOTO 200

130 I=I+1:? "What is number";I; "(or 999 if done)";

140 INPUT N

150 IF N=999 THEN ? "Numbers entered.":GOTO 200

160 NUMS(I)=N

170 GOTO 120

200 END

ADVANCED TECHNIQUES

Believe it or not, errors aren't always bad. Error codes often show what's going on inside the machine. After we're comfortable with error-handling routines, we can use this information to make our programs more user-friendly.

Before we go on, we need to know how to find out where in the program an error has occurred. The line number where the error occurs is stored in memory locations 186 and 187. To get the value, we'll create a variable ERL and assign it the value PEEK(187) *256+PEEK(186).

Atari BASIC returns a type mismatch error if it expects a number to be entered, but instead the user simply presses the [RETURN] key. This is because it interprets the [RETURN] as a single character string. Knowing this, let's set up a loop that accepts numbers until a [RETURN] is pressed.

100 TRAP 30000:REM Set error trap

110 DIM NUMS(100):I=0

120 IF I=100 THEN ? "I can't accept any more numbers.":GOTO 200

130 I=I+1:? "What is number";I; "(or <CR> if done)";

140 INPUT N

150 NUMS(I)=N:GOTO 120

160 ? "Numbers entered."

200 END

30000 TRAP 40000:REM Trap turned off

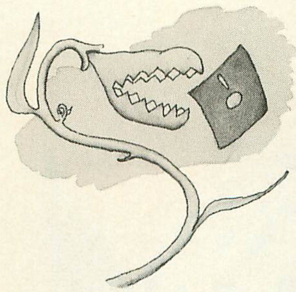
30010 ERR=PEEK(195):ERL= PEEK(186)+PEEK(187)*256

30020 IF ERR=8 AND ERL=140 THEN 160

30030 ? "Error";ERR; "at line" ;ERL; "has occurred.":GOTO 200:REM Give up

Notice that we set a TRAP 40000 at the beginning of the error-handling routine. This is redundant because the error which caused you to hit that line would disable the error trapping anyway. However, it makes this program much easier to read and modify.

Another application is to use error trapping to see when a list of DATA statements is exhausted. The programmer usually knows how much data to expect, so you can put your READ statement in a loop or check



each item READ against a number like 999 or a string such as "END" that signifies the end of the data. However, you might want to let the user customize the list, in which case having to remember how to end it is clumsy.

An example might be a list of names which can be modified depending on who's using the program. In the following program segment, imagine we're READing the names of people who are sharing pizza. Later, we'll print a list of who owes how much money. To do this, read the names into a string array until error 6—Data List Exhausted—occurs.

100 TRAP 30000

110 DIM X$(10),EATER$(200):I=0: REM Allow for 20 names of length 10 each.

115 EATER$=" ":EATER$(200)= EATER$:EATER$(2)=EATER$:REM Set array to spaces

120 IF I=20 THEN ? "Sorry, list ignored after";X$:GOTO 200:REM Too many names

130 READ X$

135 EATER$(I*10+1,I*10+10)= X$

140 I=I+1:GOTO 120

160 ? "The names are in the array."

200 REM Continue with program.

300 END

20000 DATA Charlie,Gregg,Nat, Carolyn,Marta

20010 DATA Andy,Heidi,Tom

30000 TRAP 40000

30010ERR=PEEK(195):ERL= PEEK(187)*256+PEEK(186)

30030 IF ERR=6 AND ERL=130 THEN 160

30040 ? "Error ";ERR;" at line ";ERL;" has occurred.":GOTO 300: REM Give up

The number of ways to incorporate error trapping is virtually unlimited. If you're getting data from a disk, you can use the above idea to read from the file until you get an error 136—End of File. If your program is going to write a file, a quick way to tell if the file already exists is to try to read it first. If it's not there you'll get error number 170—File Not Found. Using error trapping to check for this is easy—and may save someone from overwriting an important file.

Like any aspect of programming, a good error-handling routine should be "invisible" to the user. If you have an idea of which kinds of errors to expect, you can troubleshoot potential problems without the user ever knowing something's gone wrong. On the other hand, if your error-handling routine can't figure out what to do, you can at least print out error messages in plain English and give the user a chance to recover from the problem without a crash. Whatever the situation, error trapping is an effective way to make your programs polished, professional, and easier to run. ▲

Type-In Software

Real-World Interface

AN ATARI GROWS ORCHIDS IN TEXAS. BY JOHN LITTLE

Real-World Interface is a hardware-software project that can control a wide variety of electronic equipment with your Atari. This BASIC program works on all 8-bit Atari computers of any memory size, with disk or cassette.



Kate Murphy

The idea of using a computer to control real objects always fascinated me. Last summer I decided that something had to be done about the problem of low humidity in my orchid greenhouse and my Atari turned out to be part of the solution.

If you don't have a greenhouse, stick around anyway. The first link between my Atari and my greenhouse is a simple relay that can be used for many different applications. And programming the Atari to operate it is really easy. Also, the real-time clock routine that I use for timing relay operations can easily be incorporated into other programs.

The conventional approach to my low-humidity problem would have been to use a humidistat to control a solenoid valve (operating on house current) to control water flow to misters or foggers. But there are other considerations here in Austin, Texas where high heat can be a serious problem. I had been searching for some type of emergency system to cool the plants in case of power failure, and the best answer seemed to

be drenching them in fog.

The problem was how to generate the fog with no electricity. At the same time I decided to install misters for humidity, I came across an ingenious battery-operated water valve. I knew immediately that I had found not only a means of solving my humidity problems, but also the key to making the elusive emergency system work.

This valve comes with a programmable electronic module to control when the water will be on. It was simple to remove the module—which is, of course, just an elementary computer—and connect the valve to a much more complex computer, my Atari. Originally, the valve could be set for a maximum of four time periods per day, with the shortest time period being one minute. But with the Atari, I can turn the misters on for just seconds, and I can do it as many times a day as I want.

Just as important, with this setup I can be sure the misters don't come on when they shouldn't. Orchids should not be wet when the temperature is too low, and they should always be dry by nightfall. A thermostat placed in the circuit between the valve and the Atari makes sure that the misters don't come on if the temperature is too low. And this program lets me choose the earliest and latest times for the misters to come on.

RELAY OPERATIONS

Finally, the circuit and program are set up so that instead of operating the relay to turn on the misters, as you'd expect, the relay shuts off the misters when it operates and turns them on when it releases. If the power fails and the Atari goes down, the relay releases and the misters stay on, providing some relief from the heat until power is restored. Then, because of the internal design of the joystick ports, the relay will operate automatically and shut off the water without needing a program to tell it to. And the greenhouse fans can start drying things off.

The first step in controlling the relay is to configure the joystick port—the two jacks that the joysticks plug into. PORTA refers to Jacks 1 and 2. On the early Atari 400 and 800 computers, PORTB refers to Jacks 3 and 4.

These ports use memory-mapped I/O (input/output), which means each port corresponds to a one-byte memory address. Pins one through four in jack 1 correspond to bits zero through three at address 54016 (PORTA), and the same four pins in jack 2 correspond to bits four through seven at that address. By manipulating the data at that address with POKEs in BASIC, we can control whether each one of those pins is used for input or output, and what data we send.

Now we configure for input or output. Address 54018 (PACTL) is the PORTA controller. When bit 2 of PACTL is set to 0, any value POKEd into PORTA determines whether the individual pins of the port will be output or input pins. When bit 2 is set to 1, any value POKEd into PORTA is considered data for output.

Line 340 of the Real-World Interface program shows how bit 2 is set to zero. Its normal state is 1. To set it to 0, we subtract 4 (the decimal value represented by bit 2) from the original contents of PACTL, after saving the original contents in ORIG.

POKE PORTA with 255 to set all eight I/O pins for output. Finally POKE ORIG back into PACTL so that PORTA can send whatever data is POKEd into it.

Output from the joystick ports is binary, which means it can be in one of only two possible states: zero and one (also called low and high). Your Atari interprets these states as ground and +5-volts. Each pin that has a 0 in its corresponding bit in PORTA will send a zero or ground. Each pin with a 1 in its corresponding bit will output +5 volts. The +5 volts is how we operate the relay!

When you turn on your Atari, each pin has +5 volts. If your project is plugged into the jack when you turn your Atari on, the relay will operate. Then, when you configure the port for output, the pins will automatically drop to ground and your relay will release until you POKE the appropriate value into PORTA. This must be kept in mind when planning how your project will operate. In my case, I must remember to shut off the water valve in my greenhouse or the misters will come on when I start the program.

THE CIRCUIT

Before we get any further into the circuit, there's something you need to know about the difference between PORTA and PORTB. In the 800 and 400 each of the I/O pins in PORTB has a little "helper" in the form of a +5 volt source connected through a 4.7K resistor. The PORTA pins don't have this and when you send a "high" through a PORTA pin, it doesn't have nearly enough power to make this circuit work.

So I added a "helper" to this circuit for XL/XE owners who have only PORTA available. In *Figure 1,* resistor R3 is drawn with a dotted line. R3 is a 4.7K resistor that supplies +5 volts to the output line, similar to what's built into PORTB. You can operate this circuit from PORTB on an 800 or 400 if you omit resistor R3 and make the programming changes I'll specify later.

WATER VALVE

As it comes from the factory, the RainMatic Corp. water valve has a compartment for four C batteries, and an electronic programming module with an LCD display for setting up the watering schedule. I removed the programming module to connect the Atari in its place. I also removed the battery compartment and substituted a longer-life 6 volt lantern battery. This left two sides of the assembly open, so I had to make two crude plastic covers and caulk them well, to keep moisture, dust, and insects out of the valve assembly. The wiring simply comes out through the caulk.

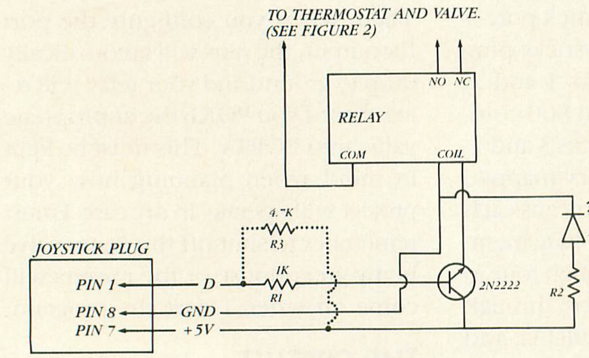


Figure 1, Attaching the relay to the joystick plug.

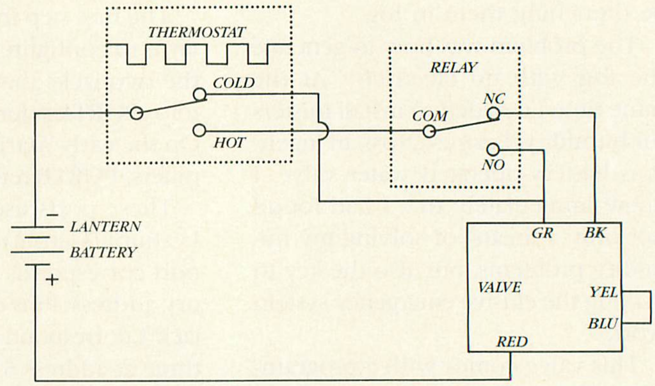


Figure 2, Attaching the relay to the valve and the thermostat.

The lead from the negative side of the battery first hits the thermostat, assuring that the valve will stay closed until the air temperature in the greenhouse is high enough.

(see figure 2)

The normally closed (NC) pin of the relay is connected to the black wire of the valve coil, which opens the valve. The normally open (NO) relay pin is connected to the green wire of the valve coil, which closes the valve.

Normally the valve is open and the water flows. To turn the water off, my program POKEs a 1 into PORTA and +5 volts is sent on pin 1. This closes the relay and voltage from the lantern battery is applied through the thermostat and the relay to the green lead on the valve, which closes.

Voltage continues to be applied to the green lead, but nothing happens. There is no battery drain because a switch inside the valve opens the circuit. When it's time for the water to come on again, the program POKEs 0 into PORTA. The relay releases, removing voltage from the green lead and applying it to the black lead. The valve opens and the water flows again.

A lead runs from the COLD side of the thermostat to the green wire of the valve. This insures that the valve will automatically close if the temperature drops below the threshold while the water is on.

PARTS LIST

PC BOARD	Radio Shack #276-168
R1, R2	1K Ohm Resistors
R3	4.7K Ohm Resistor
TRANSISTOR	2N2222
RELAY	Radio Shack #275-216
LED from Radio Shack	
9-conductor ribbon cable	
9-pin female connector	

THE CLOCK

The heart of my Atari clock is a machine-language program running in the vertical-blank interval. It is based on OS location RTCLOK (18, 19, 20), but only reads location 20, which counts jiffies (1/60 seconds).

Real-World Interface uses locations 19 and 18 to store the count of seconds and minutes, respectively, obtained by watching the content of location 20, resetting it when it reaches 60, and incrementing the seconds count at the same time.

I wanted to store the count of hours in Page 0 so it could be accessed quickly. I chose location 207, which seems to be unused by most versions of DOS and BASIC. I also used 208 and 209 for counting jiffies. Location 20 is actually updated every 1/59.92334 second—not every 1/60 of a second. In the short run, this isn't enough of an error to cause much trouble. But with a continuously running clock, the error builds up surprisingly fast.

So I built a correction factor into my clock. Since the Atari timer gains a tiny fraction (0.07666) of a jiffy each second, I calculated how many jiffies it was gaining in a minute (4.5996). Dividing this number into the number of seconds in a minute yielded 13.044612 seconds, which told me how often I needed to increment the jiffy counter to keep the clock as accurate as possible. Since 13.044612 seconds equal 782.67672 jiffies, I rounded off my number to 783. That's what the clock program counts to before adjusting the jiffy counter.

I realize this may seem like nitpicking to some, but achieving the highest possible accuracy allows a continuously running program like my greenhouse tender to go longer between clock resets.

ABOUT THE PROGRAM

Type in Listing 1, INTRFACE.BAS, check it with TYPO II and SAVE a copy before you RUN it.

Some simple line-editing will turn INTRFACE.BAS into a universal relay-controlling program. Since the water goes on when the relay is off, all that's required is to replace the word WATER with RELAY and ON with OFF (and vice versa) in the following lines: 900, 920, 1020-1070, 1112-1160, 1190, 1200, 1280, 1320. Also swap lines 500 and 510.

To RUN the program using PORTB on an Atari 400 or 800, just change line 5 to: 5 LET A800=1

When RUN, INTRFACE.BAS loads my machine language timing routine into the second half of Page 6.

Next, the variables are declared and the clock is initialized beginning at line 100. The program asks if you wish to reset the clock, which is on a 24-hour cycle, not 12 hours, and will accept either an uppercase or lowercase response.

If you choose to set the clock, the time is displayed onscreen until you press [START]. If the clock hasn't been set, don't answer No to the reset prompt, otherwise the clock will run at one-fourth speed. Merely stopping INTRFACE.BAS will not stop the clock.

After configuring the port for output, the program calls subroutines at lines 880 and 1110 that request all timing parameters. These parameters specify how the relay will function. First the program asks for the earliest and latest start times. If you answer the first prompt with a [RETURN] only, it will assume that round-the-clock operation is okay.

Next, the program asks for the length of time you wish the water to be on, and the length of time you wish it to be off. If you press [RETURN] at each of these prompts, the program jumps to the manual operation routine at line 1240. This routine asks if you wish to turn the water on or off before exiting the program.

Before operation actually begins, the time is displayed at the top of the screen. Several options are offered at the bottom of the screen.

At this point you can stop the program with the water on, stop with water off, or if you want to change one of the parameters, you may re-start the program without resetting the clock. These options are also available while the program is running.

Finally, press any key to start the timer.

PROGRAM TAKE-APART

In lines 440-460, the program checks to see if it's time to operate a relay. If so, lines 500 and 510 initialize variables before calling the timing and relay subroutines.

In lines 600-730, the program gets the correct time, adds to it the amount of time specified for the relay to be operated or released, and adjusts any minute or second values greater than 60, or hour values greater than 24.

Lines 770-820 contain the timing loops, one each for second, minute, and hour.

Lines 840-847 hold the subroutine that displays the time at the top of the screen. ▲

John Little has been programming Ataris and tinkering with hardware projects since 1984.

Listing on page 28

EQUIVALENCE
continued from page 48

name table. Be sure your program knows how to search through the variable tables for the information it needs.

OTHER USES

The previous examples mostly speed disk I/O. But there are many other powerful ways to use equivalenced variables, such as creating and manipulating pseudo-records and defining pointers.

Pascal lets you to declare RECORD data types. A RECORD is a variable which contains other variables. For example, a single RECORD variable for a banking program might contain a person's name (a string), an account number (an integer), and account balance (a floating-point number).

You can emulate a RECORD in BASIC by consecutively equivalencing a set of variables into one large string.

This form may be useful for creating a small database or other systems where you need to keep data grouped together in a particular fashion.

You can also use equivalenced variables to emulate pointers. Just find the string's eight-byte block in the variable value table and change its offset (bytes three and four) to point to the desired memory location. In Listing 1, for example, we made the string point to the audio control registers.

Try some high-speed screen I/O. Create a string the same size as the screen and point it to screen memory. Anything you put in the string will appear onscreen *instantly*.

PROGRAM TAKE-APARTS

Listing 1 equivalences a string with the audio control registers, memory locations 53760-53767. S$ is an eight byte string that is offset so that it points to those locations. CH$ contains the frequency, distortion, and volume values for each of the eight audio control registers.

The first part of Listing 1 takes the frequency, distortion, and volume values from CH$ and puts them into the SOUND command.

You could speed up this routine by storing these values in an array. This would avoid the string-to-floating-point conversions, but would require 4,608 bytes of memory instead of 256 bytes (nine times more space) and would still be slower than the second part of the program.

In the second part, the program sets S$ as a pointer to the audio control registers. They are set very quickly by copying eight-byte substrings of CH$ into S$.

Listing 2 demonstrates the generalized method for equivalencing variables. As written, it can be RUN in Atari BASIC or Turbo BASIC XL.

Listing 2 begins by asking for the size of the floating-point array M(). After DIMensioning M() and the string variables, Listing 2 finds the location of each of the variable tables.

Next, the program jumps to the subroutine at line 2000 to find the variable number, offset and dimensions of M() and S$. The actual equivalencing of M() and S$ occurs in lines 380-500. Lines 520-1250 contain the I/O and initialization benchmarks for the data in *Figure 1* and *Figure 2*.

The subroutine at line 1500 contains a timer and the subroutine at line 1600 prints the first five elements of M() to show that the contents of M() actually do change during the benchmark routines.

Doug White of Arlington, Texas uses his 1200XL as an aid in designing and testing loudspeakers. This is his first appearance in ***Antic****.*

Listing on page 32

Celebrity Cookbook, Cheat!

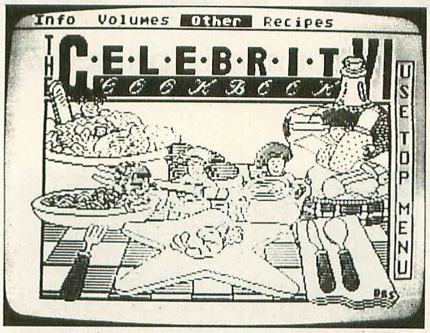
CELEBRITY COOKBOOK

Liz Taylor's diet lunch, Rock Hudson's hot buttered rum, Boy George's diet breakfast, Ronald Reagan's corned beef, Sophia Loren's first-course pizza. . . Does your recipe filing system consist of musty 3-by-5 cards and food-stained newspaper clippings stuck into your crumbling copy of "The Joy of Cooking"? With this first installment of a promised six-volume **Celebrity Cookbook** series, it's easy to take charge of your recipes.

The software contains 50 celebrity recipes, plus goodies such as diet secrets of the stars, a wine directory, bartender's guide and Perle Mesta's Party Tips. All recipes can be displayed onscreen or printed out. You can resize recipes in terms of the number of servings and print a shopping list for any recipe.

Menu selection can be made with the keyboard, joystick or ST mouse, although the joystick action seems too fast. The Cookbook's publisher is working on the mouse-driven Graphics Operating Environment for the Atari 8-bit. The joystick doesn't work at all in the main menu—a small flaw, but potentially confusing. When using the keyboard, the [ARROW] and [RETURN] keys do most of the work.

The heart of the program is the filer for your own personal recipes—My Favorite Recipes. This is really a small word processor and database, with cut-and-paste and search functions. You can ask for chicken recipes, recipes using anise, or recipes under a heading you define as "I'm tired and it's easy." With a little experimentation, anyone can start filing right away. But don't go too far too soon, print the help file first. It explains the data entry process, defining your



fields and the more advanced functions of the filer program.

To me, a recipe filer seems to be one of those applications for which the technology of choice is still pencil, paper and rusty 3×5 file box. Our computer lives close to the kitchen—in the dining room, cohabiting with 10,112 toys. But typing in all of our recipes seems like an awful lot of work. And my review copy had a printing bug. My personal recipes printed out fine, but the celebrity recipe printouts repeatedly crashed the computer. I mailed the disks back to the company around the time it moved from Palm Springs to Maryland. At deadline I had received no response.

If you do want your recipes on disk, Celebrity Cookbook is for you. The program is fun, easy and well-conceived and designed. Now if I could only figure out how to attach my blender to the cartridge slot.—DAVID MERRIHUE

$29.99, 48K disk. U.S.A. Media, 7810 Malcolm Road, Clinton, MD 20735. (301) 868-5494.

CHEAT!

Cheat! intrigued me immediately. I don't know how many times I've wished I'd had unlimited lives in a video game, or that I could advance past that screen that had confounded me for countless days and countless quarters. Well, although Cheat! won't help you very much in the arcades, at least home players can end some of the torture.

Cheat! is a game utility which makes a working copy of your favorite game, modified to allow unlimited lives. The only drawback of Cheat! is that it will only work for the titles it recognizes. And while the list is more than 100 titles long, there were only a couple of titles I had even heard of (and only one that I had available)—and I have hundreds of commercial games. Perhaps the other titles were public domain or shareware.

But this aside, I selected Boulder Dash from the list to see how Cheat! worked. And it didn't. I followed the instructions precisely. Cheat! told me it couldn't locate the "Lose Life Routine," or something like that. Then it babbled about sector locations—gibberish to a technical novice like me. I can run any program, but I'd be hard pressed to peek into any disk files.

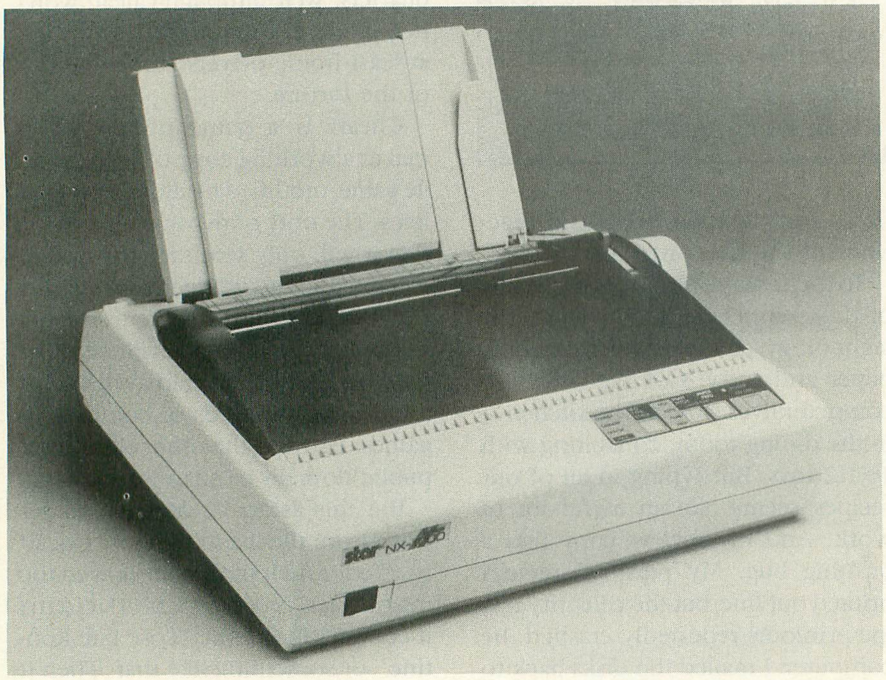
In short, if you're thinking of buying this one, make sure it works with some of your titles, or you'll be stuck with a $25 conversation piece.

While I don't think that any game on the market would drive me to buy Cheat!, I'm sure that some of you have programs you still haven't mastered, or a level or two you still haven't visited. Cheat! might be your only hope.—STEVE PANAK

$24.95, 48K disk. Alpha Systems, 1012 Skyland Drive, Macedonia, OH 44506. (216) 467-5665.

NX-1000 RAINBOW

First affordable COLOR dot-matrix printer. *By Matthew Ratcliff*



The **Star NX-1000 Rainbow** is the first affordable and practical graphics-capable dot-matrix *color* printer. First there was the Epson JX-80 dot-matrix, which cost about five times more than the Rainbow. Then there were the more affordable Okidata thermal-transfer color printers, which used very expensive ribbons, were extremely slow, did not work with many popular printing programs and did not do a very good job of printing normal all-text pages. The NX-1000 Rainbow provides all the practicality of a standard dot-matrix printer, plus the beauty of vivid color—all at a reasonable price.

Except for color printing, the Rainbow is nearly identical to the standard NX-1000 printer reviewed by Gregg Pearlman in the October 1988 **Antic**. The Rainbow also has several type-styles and fonts, all selectable via multiple panel-button presses—including draft and near letter-quality Courier, two Orators and Sanserif.

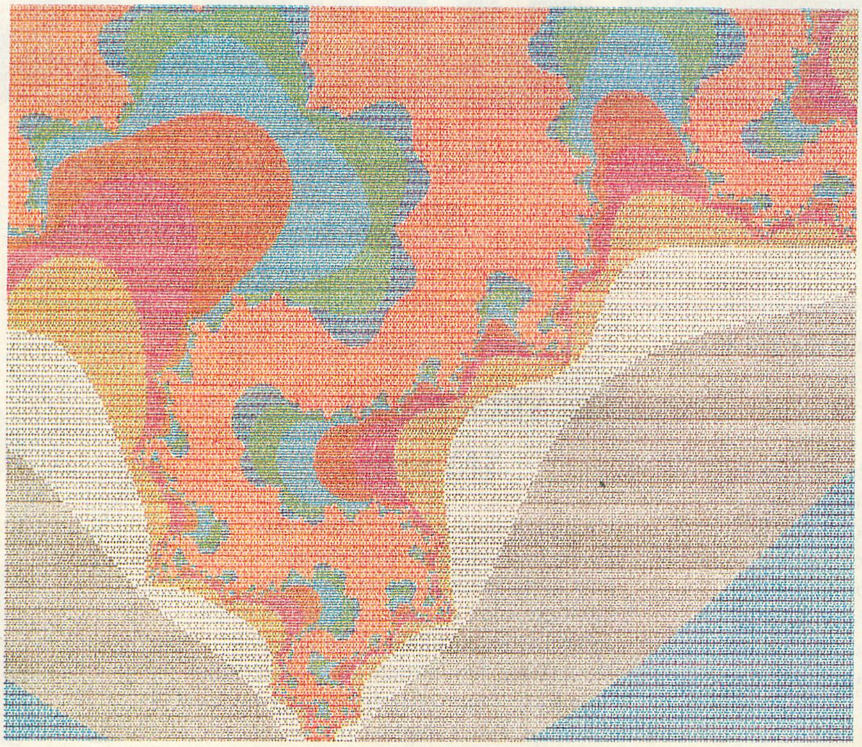
Unfortunately, color selection was not added to the panel for the Rainbow. Most software does not directly support color printing, so this would have been a very convenient enhancement. The Rainbow is completely Epson JX-80 compatible, and for Atari ST users a DEGAS printer-driver called JX80. PRT is already available on CompuServe's SIG-Atari.

Atari 8-bit owners can print color graphics on the NX-1000 Rainbow or the JX-80 with YEMACYB/4 software ($29.95) by Electronical Software, P.O. Box 8035, Rochester, MI 48063. This color screen dump utility is capable of printing your favorite Micro Illustrator formatted pictures in full color. Naturally, the 8-bit needs a printer interface such as ICD's P:R: Connection to work with the NX-1000.

The Rainbow has a rear tractor feed mechanism, giving it the ability to perform a reverse form feed. I'm willing to put up with the nuisance of a rear tractor feed (it's difficult to get to and load paper properly) for this added feature, which greatly simplifies color separation printing.

Using Publishing Partner Professional software, the Atari ST can print images in color separation style, each color requiring a separate pass through the printer, followed by a reverse form feed. The entire page is printed first in magenta, then cyan, yellow and black. The original YEMACYB program (Reviewed in the July 1987 **Antic**, also available for $29.95 from Electronical Software.) supports multi-color printing like this on single-color printers, prompting you to change the color of the ribbon between each pass. With the NX-1000 Rainbow and YEMACYB/4, you get faster and more convenient one-pass color printing.

I was able to find some classic DEGAS pictures and print them on the NX-1000 Rainbow. Since I have



The Rainbow provides the practicality of a dot-matrix printer, plus the beauty of vivid color.

been playing with Lightspeed C on the 8-bit Atari growing Mandelbrot set fractals (**Antic**, November 1988), I had a lot of fun dumping color fractals to the Rainbow as well. The Rainbow does a very good job, much better than the Okidata thermal-transfer printers. And pictures are much less expensive to generate, thanks to the Rainbow's multi-pass fabric ribbon.

The ribbon has four color bands: black, cyan (blue), magenta and yellow. It seemed to wear out rather quickly. Many of the newer printers using cartridge ribbons have small re-inking rollers built in, but the multiple color bands of the Rainbow's ribbons make such re-inking impossible. NX-1000 color ribbons cost about $11 each and the black-only ribbons run approximately $6.

Colored text is quite simple to access from any word processor. Color and font commands are sent to the printer by placing the letter C for color, or F for font selection, within a pair of double parentheses followed by a single ASCII digit indicating the font or color selected. ((C))1 would tell the Rainbow to print RED text. ((F))0 would select the near letter quality Courier font.

The only drawback with these five-character command codes is that your word processor treats those characters as text, but the printer gobbles them up as a command. This may cause some margin problems in your text, but you can work around this by keeping color and font commands on lines separate from the main body of the text. Colors such as green are created by the printer in two passes, first in yellow and then reprinting the line in cyan. When NLQ printing is enabled, all text is printed twice to get the higher resolution. If you have a rather tired ribbon, you may wish to enable double-strike printing for a darker output. Printing green, NLQ, double-strike text on the NX-1000 Rainbow will require six passes of the printhead per line of text! The output is beautiful, but slow.

I have found that you can select a single color, say green or red, from a simple BASIC program and then run the Hi Tech Expressions 8-bit programs Print Power or Sesame Street Print Kit. All your cards and posters will print in that chosen color.

Other features of the NX-1000 Rainbow include some niceties like a power switch at the front, where it belongs. The printer connector and power cord are on opposite sides of the printer, not hanging off the rear where they can obstruct the paper path. Print and graphics quality of both black and color are very acceptable.

The rear tractor feed also provides for a feature called Paper Park. The Rainbow will reverse feed the paper, extracting it completely from the platen. Changing from tractor to friction feed, you can insert single sheet paper from above the printer. When done, simply return to tractor feed and press the panel buttons for a form feed. The Rainbow will automatically reload your paper. Unfortunately, the printer does not find the precise top of form upon reload, requiring manual adjustment.

The NX-1000 Rainbow has added a whole new dimension to my personal computing. ▲

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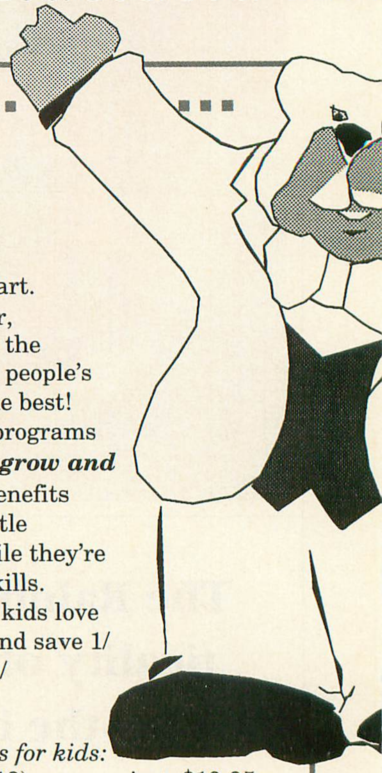
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Tech Tips

BOOLEAN STICK

By Brian Murphy

It's a fairly easy task to program your joystick for drawing on the screen while avoiding Error 141 (cursor out of range). A simple program to handle such an exercise might look like this:

```
10 GRAPHICS 7+16
20 COLOR 1
100 S=STICK(0)
110 IF S=7 THEN X=X+1
120 IF S=11 THEN X=X-1
130 IF S=13 THEN Y=Y+1
140 IF S=14 THEN Y=Y-1
150 IF S=5 THEN X=X+1:Y=Y+1
160 IF S=6 THEN X=X+1:Y=Y-1
170 IF S=9 THEN X=X-1:Y=Y+1
180 IF S=10 THEN X=X-1:Y=Y-1
190 IF X>159 THEN X=159
200 IF X<0 THEN X=0
210 IF Y>95 THEN Y=95
220 IF Y<0 THEN Y=0
230 PLOT X,Y
240 GOTO 100
```

But there is a much better way to code this function using Boolean Logic. You see, Atari BASIC assigns a value of one to any equation or inequality that is true and zero to any that is false. It is important to realize that you don't need the convention of an IF. . .THEN statement in order to have an expression such as T=5 evaluated as true (one) or false (zero). For example:

```
10 T=5
20 ? T=5
```

In this example the value five is assigned to T—so the expression T=5 in line 20 is evaluated to be one. This mini-program will print a one.

Armed with this background information we're ready to rewrite the joystick function. Just replace lines 110 through 220 in the above program with the two following lines:

```
110 X=X+((S=5)+(S=6)+(S=7))*(x<159)-((S=9)+(S=10)+(S=11))*(X>0)
120 Y=Y+((S=5)+(S=9)+(S=13))*(Y<95)-((S=6)+(S=10)+(S=14))*(Y>0)
```

The parentheses ( ) in the procedure are included to ensure that everything is evaluated in the proper order. Very often when using Boolean Logic you will need such parentheses. Also note that I used addition (+) to represent Logical OR and multiplication (*) for Logical AND. This is possible *only* if there is mutual exclusion—only *one* of the possible conditions can occur at any instant of time. Since a joystick can only be pointed in one direction at a time, we are assured of mutual exclusion.

Obviously this routine makes the program much shorter, requiring less memory. This new coding replaces twelve lines with just two. In many cases multiple IF. . .THEN statements that require separate lines can be summed up in one line.

A joystick routine is only one of many possible uses for Boolean Logic expressions. By using Boolean Logic throughout your routines you can save a great deal of RAM for that extra feature you just couldn't fit in.

AUTORUN SETUP

By Robert Wallace

Antic published a September 1988 Tech Tip called AUTOGO.BAS which creates an autorun file that will LOAD and RUN BASIC programs. But this great utility already exists and most Atari users already have it without knowing. On the DOS 2.5 master disk there is a SETUP.COM file which will create AUTORUN.SYS files for BASIC.

The menus are easy to follow. Note that SETUP.COM will work on the disk in drive 1 unless you use option 1 in the menu below:

Choose an option:

1. Change current drive number
2. Change system configuration
3. Set up AUTORUN for Boot

The DOS 2.5 Master disk came with new Atari drives from the 1050 on. If you don't have a copy, check with your local dealer or users group about the best way to get a copy.

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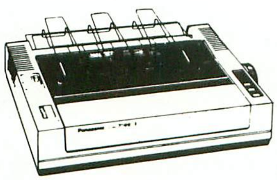
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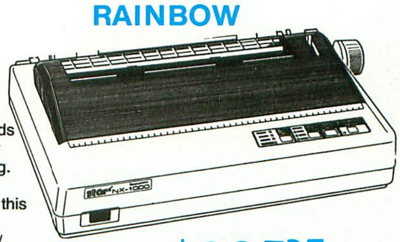


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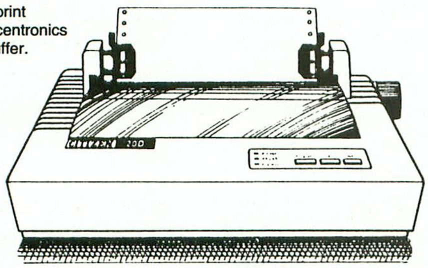
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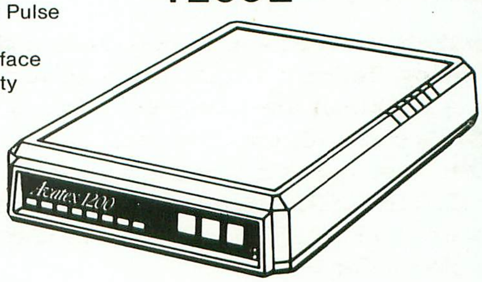


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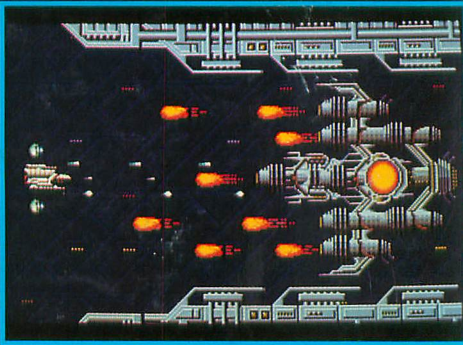
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The planet Draconia, an unnatural planet, has been formed over many centuries by six of the most feared rulers that have ever existed. These rulers, exiled from their home galaxy, have ravaged and plundered space, using the worlds they have destroyed and the life forms they have created to build this planet of fear and death.

Now an end must be put to their reign of terror. A large scale attack will prove too costly to our space fleets. Draconia has many orbiting defence systems, the sacrifice may be in thousands of lives. A single fighter craft, approaching undetected, may have a chance to avenge those who have perished, by destroying Draconia. You have that chance . . .

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